

**BUSINESS PLAN ANALYSIS OF A NEW REVERSE OSMOSIS PLANT AT A
URANIUM MINE, THE RABBIT LAKE OPERATION – EAGLE POINT MINE**

by

Mehran Khosravinejad

B.A.Sc. Mining & Mineral Process Engineering, University of British Columbia, 2002

PROJECT SUBMITTED IN PARTIAL FULFILLMENT OF
THE REQUIREMENTS FOR THE DEGREE OF
MASTER OF BUSINESS ADMINISTRATION

In the Faculty
of
Business Administration

© Mehran Khosravinejad, 2011
SIMON FRASER UNIVERSITY
Spring 2011

All rights reserved. However, in accordance with the *Copyright Act of Canada*, this work may be reproduced, without authorization, under the conditions for *Fair Dealing*. Therefore, limited reproduction of this work for the purposes of private study, research, criticism, review and news reporting is likely to be in accordance with the law, particularly if cited appropriately.

Approval

Name: **Mehran Khosravinejad**

Degree: **Master of Business Administration**

Title of Project: **Business Plan Analysis of a New REVERSE OSMOSIS
Plant at a Uranium Mine, the Rabbit Lake Operation –
Eagle Point Mine**

Supervisory Committee:

Dr. Mark Selman

Director, Learning Strategies Group, Beedie School of
Business, Simon Fraser University

Dr. Colleen Collins,

Associate Dean & Academic Director, Beedie School of
Business, Simon Fraser University

Date Approved:

Abstract

This thesis provides a prefeasibility justification for a new Reverse Osmosis Water Treatment Plant at Cameco's Rabbit Lake operation. The economics of the proposed project are discussed in detail including an in-depth explanation of the uranium industry, required capital investment, and expected gains. As well, the potential environmental and social effects of constructing the reverse osmosis facility and extending the life of the Eagle Point mine are examined. After all potential impacts of this project are considered, it is concluded that a reverse osmosis plant is the most beneficial method for dealing with increasing water inflows at the Eagle Point underground mine.

Keywords: Rabbit Lake Operation; Eagle Point Mine; Uranium Industry; Reverse Osmosis; RO

To my parents, who taught me to value knowledge and education.

Acknowledgements

I am grateful to Mr. David Rezansoff, Mr. Dave Leavitt, Mr. Stephen Mason and Mr. David Hemeon for being exceptional supervisors at the Rabbit Lake Operation. I am indebted to these three gentlemen for their continuous support, guidance, and inspiration.

I am thankful to the members of my advisory committee, Dr. Mark Selman and Dr. Colleen Collins, for their valuable guidance, direction, insight, and timely support through this project.

I am thankful to all supporting staff at the SFU Faculty of Business, who made this MBA program functional.

I also thank the amazing group of people at the Rabbit Lake Operation. Their friendship, support, and wisdom have improved the quality of my work and life. I especially thank Mr. Randall Peters, Mr. John Lancaster, and Mr. Geoff Maes at the Rabbit Lake Operation for their wonderful support throughout the course of my MBA program.

Finally and most importantly, I thank my family, my siblings, and my cousins for their continued love, support, and strength, and especially my wife, Elham, for her unconditional love and inspiration.

Table of Contents

Approval	ii
Abstract	iii
Dedication	iv
Acknowledgements	v
Table of Contents	vi
List of Figures	ix
List of Tables	x
1: Introduction	1
2: Operation History Background	3
2.1 Rabbit Lake Operation	3
2.1.1 Eagle Point Mine	4
2.2 Cigar Lake Mine.....	4
2.3 Rabbit Lake In-Pit Tailings Management Facility	5
2.4 Rabbit Lake Location	6
3: Industry Analysis	10
3.1 Nuclear History 101	11
3.2 Uranium Mining and Milling	14
3.3 Future Uranium Supply and Demand.....	15
3.4 Market Overview.....	20
3.5 Key Players	21
3.6 Michael Porter's Five Forces	22
3.6.1 Existing Competitive Rivalry among Suppliers	22
3.6.2 Threat of New Market Entrants.....	23
3.6.3 Power of Suppliers	23
3.6.4 Bargaining Power of Buyers	24
3.6.5 Threat of Substitute Products	24
3.6.6 Regulators and Complementors	24
3.6.7 Summary of Michael Porter's Five Forces.....	24
4: Value Chain	26
4.1 Existing Value Chain.....	26
4.2 New Value Chain	28
4.3 Value Chain Summary	30
5: Eagle Point Mine	31
5.1 Life-of-Mine Plan.....	31
5.1.1 Reserves in the Mine Plan	34

5.1.2	Reserve Remnants	36
5.1.3	Resources and Unclassified Mineralization in the Mine Plan	37
5.1.4	Measured, Indicated, and Inferred Resources Not in the Mine Plan	37
5.2	Eagle Point Growth Potential	38
5.3	Eagle Point Exploration Potential	39
5.4	Mine Development Estimation	39
5.5	Dewatering Requirements	40
6:	Detailed Project Description	41
6.1	Project Overview	41
6.2	Cameco Safety, Health, Environment, and Quality Management System	45
6.3	Project Components	46
6.3.1	Underground Mine Water	46
6.3.2	Water Treatment Facilities	47
6.3.3	Water Discharge	48
6.3.4	Electrical Power Requirements	49
6.3.5	Ground Preparation	49
6.3.6	Waste Management	49
6.4	Decommissioning and Reclamation	50
6.5	Project Schedule	50
7:	Existing Environment	51
7.1	Terrestrial Environment	51
7.1.1	Wildlife	51
7.2	Aquatic Environment	51
7.2.1	Aquatic Species	51
7.3	Resource Use	51
7.3.1	Traditional and Non-traditional Land Use	51
7.3.2	Socio-economic Environment	52
8:	Potential Effects	53
8.1	Spatial and Temporal Boundaries	53
8.2	Potential Project–Environment Interactions	53
8.2.1	Biophysical Environment	57
8.2.2	Human Health and the Socio-Economic Environment	57
8.3	Environmental Pathway Interactions, Mitigations, and Determination of Potential Effects	58
8.3.1	Sensory	58
8.3.2	Atmospheric Environment	58
8.3.3	Aquatic Environment	58
8.3.4	Terrestrial Environment	60
8.3.5	Occupational Hazards	62
8.3.6	Economy	62
8.3.7	Land and Resource Use	62
9:	Stakeholder and Community Engagement	64
9.1	Objectives	64
9.2	Guiding Principles	65

9.3 Engagement of Primary Communities	66
10: Economic Analysis	67
10.1 Care and Custody (No More Eagle Point).....	67
10.2 Capital to Keep the Eagle Point Mine Operational	67
10.3 RO Plant Capital.....	67
10.4 Operating Cost.....	68
10.5 Discount Rate	68
10.6 Other Assumptions	68
11: Economic Assessment	69
11.1 Net Present Value.....	69
11.2 Sensitivity Analysis.....	69
11.3 Break-Even Point	70
11.4 Benefit–Cost Ratio	70
11.5 Economic Summary	71
12: Conclusion.....	72
Appendix A: Timeline of Uranium Spot Price Movements	73
Appendix B: Economic Assessments	77
13: Bibliography	80

List of Figures

Figure 2-1: Rabbit Lake Operation.....	3
Figure 2-2: Eagle Point Mine	4
Figure 2-3: Cigar Lake Mine	5
Figure 2-4: Rabbit Lake In-Pit Tailings Management Facility	6
Figure 2-5: Location of the Rabbit Lake Operation	7
Figure 2-6: Aerial View of the Rabbit Lake Operation.....	8
Figure 2-7: Athabasca Basin Communities and Bodies of Water	9
Figure 3-1: World Net Electricity Consumption (in billions of kWh)	10
Figure 3-2: World Electricity Generation by Nuclear Power	11
Figure 3-3: Uranium Production vs. Demand	12
Figure 3-4: Nuclear Fuel Cycle	14
Figure 3-5: New Build Outlook - Gross GWe.....	16
Figure 3-6: Fuel Conversion.....	17
Figure 3-7: Future Uranium Supply/Demand 2010-2019	18
Figure 3-8: Existing Mines-10 Largest in 2010.....	19
Figure 3-9: Porter's Five Forces - Uranium Industry.....	25
Figure 4-1: Existing Value Chain.....	27
Figure 4-2: New Value Chain.....	28
Figure 5-1: Graphical representation of Base Case - Life of Mine Production 2011	33
Figure 5-2: Proposed 02 NExt Hydrological Bulkhead Locations	34
Figure 5-3: 2011 Growth Life of Mine Plan.....	38
Figure 6-1: Proposed Reverse Osmosis Addition to the Rabbit Lake Water Handling	43
Figure 6-2: Proposed Location of the RO Plant and related infrastructure	44
Figure 11-1: Tornado Diagram of NPV Increase	70
Figure 12-1: Timeline of Uranium Spot Price Movements, 1987–2004	74
Figure 12-2: Timeline of Uranium Spot Price Movements, 2004-2006.....	75
Figure 12-3: Timeline of Uranium Spot Price Movements, 2006-2010.....	76
Figure 12-4: Economic Assessment - Eagle Point Operating Until 2017	78
Figure 12-5: Economic Assessment - Eagle Point Operating Until 2017	79

List of Tables

Table 3-1: New Build outlook - Planned Reactors.....	15
Table 3-2: Key Uranium Suppliers.....	22
Table 4-1: Water Inflow Predication	29
Table 5-1: Reserves as of March 2011	31
Table 5-2: Resources as of March 2011	32
Table 5-3: Development Estimation.....	39
Table 8-1: Potential Effects to Biophysical Environments.....	55
Table 8-2: Potential Effects to Human Health and Economic and Resource Environments.....	56

1: Introduction

Cameco's Rabbit Lake operation, located in northern Saskatchewan, was begun in 1975. Its Eagle Point mine, also in northern Saskatchewan, has been producing uranium since 1994. The Rabbit Lake operation is currently mining uranium from the Eagle Point mine and milling the mined uranium at the Rabbit Lake mill to produce yellow cake (U_3O_8). Cameco's Cigar Lake mine is a new mine that is expected to be commissioned in 2016. At present, it is expected that the first stages of the milling process of Cigar Lake ore will take place at AREVA's McClean Lake operation, with the remainder of the milling process completed at the Rabbit Lake mill.

The Eagle Point mine is an underground mine, which is partially located under Wollaston Lake. Removing ore from the Eagle Point mine generates a large amount of water, which is flowing into the mine. The water is contaminated by heavy metals that must be removed at the water (effluent) treatment plant at the Rabbit Lake mill prior to being released. Failure to treat the water would cause significant downstream problems and create significant societal and licensing issues.

Initially, ore production at Eagle Point was expected to last until 2002. However, exploration has led to additional reserves, extending the life of the mine. Expansion of the mining activity is going to increase the flow of water that needs to be treated. The existing treatment plant is already a bottleneck; it is expected to reach maximum capacity by the end of 2012. This bottleneck is threatening to shut down the mine, even though there is additional ore available. Also, both regulatory and corporate social responsibility aspects are pressuring the Rabbit Lake operation to reduce pollutants in the treated effluent stream; positively responding to this pressure will mean that the capacity of the existing treatment plant will soon be exceeded. This is quite aside from the issue of increased volumes of water as the mine is extended.

Efforts to reduce the amount of water flowing into and out of the Eagle Point mine have been somewhat successful but not so successful as to eliminate the problem. A possible option is further expansion of the conventional treatment plant; this would be very expensive and would produce a negative result, more pollutant loadings to the environment. An alternative to expansion would be to install a reverse osmosis (RO) plant, which would be used as a first stage treatment that would separate the effluent into two streams, one of which would be cleaner than

what is currently released, the other of which would be highly concentrated. The reduced volume of water in the concentrated stream could then be reprocessed and run through the existing treatment plant.

The decision to undertake a project of this scale requires a complete understanding of the environments surrounding the Rabbit Lake operation. The physical environment, i.e., people, wildlife, land, and bodies of water, will be affected. These effects, both positive and negative, must be studied in detail and are generally presented in the form of an impact study. This paper will briefly describe how each aspect of the physical environment is affected.

The economic environment, i.e., supply and demand of uranium and employment opportunities during construction, operation, and decommissioning of the new facility must also be carefully considered. Socio-economic issues play an ever-larger role in decisions of this magnitude. Cameco must gain an understanding into how environmental effects may influence the livelihood of the Athabasca Basin population. Cultural and traditional use of the land and water bodies must also be taken into consideration.

If a reverse osmosis plant is built, Rabbit Lake operation will maintain ore production at the Eagle Point mine. If a reverse osmosis plant is not built, the Eagle Point mine production will shut down and the Rabbit Lake mill will go into care and custody until the Cigar Lake mine is commissioned in 2016. The existing water treatment capacity is more than sufficient to treat the water produced at the Cigar Lake mine. As a result no further expansion of the water treatment plant would be required.

Putting the Rabbit Lake mill into care and custody with the expectation of reopening it when Cigar Lake is commissioned is unattractive, given the costs of both maintenance and start-up and the challenges of assembling a qualified workforce from scratch in 2016. Economic analysis indicates that the reverse osmosis plant has the potential to deliver some return on investment at low risk in the interim period, while improving environmental performance and maintaining local employment over the next five years.

2: Operation History Background

2.1 Rabbit Lake Operation

The Rabbit Lake (RL) project was originally owned, and operated by Gulf Minerals Canada Limited. The first ore body (Rabbit Lake Pit) was discovered in 1968. The company finished the feasibility studies in 1972 and began construction of what is now the longest operating uranium production facility in Saskatchewan. The construction of the mill took three years, with ore first being introduced on June 10, 1975. Four additional ore bodies were discovered between 1971 and 1980 (A-zone, B-zone, D-zone, and Eagle Point). B-zone began production in 1985, followed by D-zone in 1996 and A-Zone in 1997. Production of ore from the Eagle Point underground mine began in 1994 and is still ongoing.

The original RL mill design capacity was 1600 dry tonnes per day, but over its many years of service many modifications were made, with peak capacity reaching more than 2900 dry tonnes per day in 1981. With this increase in capacity, the RL mill became the second largest uranium milling process in the world.

Figure 2-1: Rabbit Lake Operation



(Cameco Corporation, 2010); This and subsequent images used with permission of Cameco Corporation

2.1.1 Eagle Point Mine

The Eagle Point (EP) mine is located approximately 15 km or 10 mi from the RL mill. It was commissioned in 1993 and currently has reserves and resources remaining amounted to 39.7 million pounds (March 2011). The RL mill currently processes ~3.7 million pounds of uranium per year from the EP mine.

Figure 2-2: Eagle Point Mine



(Cameco Corporation, 2010)

2.2 Cigar Lake Mine

The Cigar Lake (CL) mine is the world's largest undeveloped high-grade uranium deposit. The mine is expected to be in production by early 2016. The ore from CL is to be trucked to AREVA's McClean Lake operation, where it would be partially processed (leached out). The resulting uranium solution, which is mill process water containing the rich uranium and other impurities, will then be transferred to the RL mill for further processing. It is estimated that ~10 million pounds of uranium solution would be processed at the RL mill to produce uranium concentrate (U_3O_8).

Figure 2-3: Cigar Lake Mine



(Cameco Corporation, 2010)

2.3 Rabbit Lake In-Pit Tailings Management Facility

The RL pit was mined from 1974 to May 1984. The RL pit was converted to a pervious surround tailings management facility in November 1984. The tailings from processing uranium ore from the RL mill were then deposited into the RL tailings pit. Currently, the RL tailings pit facility has limited capacity to deposit tailings. The Rabbit Lake operation is in the process of developing a new tailings management facility to deposit new tailings generated from processing of the Eagle Point ore and Cigar Lake uranium solution. This new tailings management facility, which will begin operation in 2013, will have sufficient capacity to deposit tailings from future processing of new ore bodies.

Effluent produced by water seeping from the tailings is collected and either pumped into the RL mill to be reused as process water to mill uranium ore or treated in the effluent plant mill. This collected effluent is known as raise water; it represents a large percentage of the effluent requiring treatment.

Figure 2-4: Rabbit Lake In-Pit Tailings Management Facility



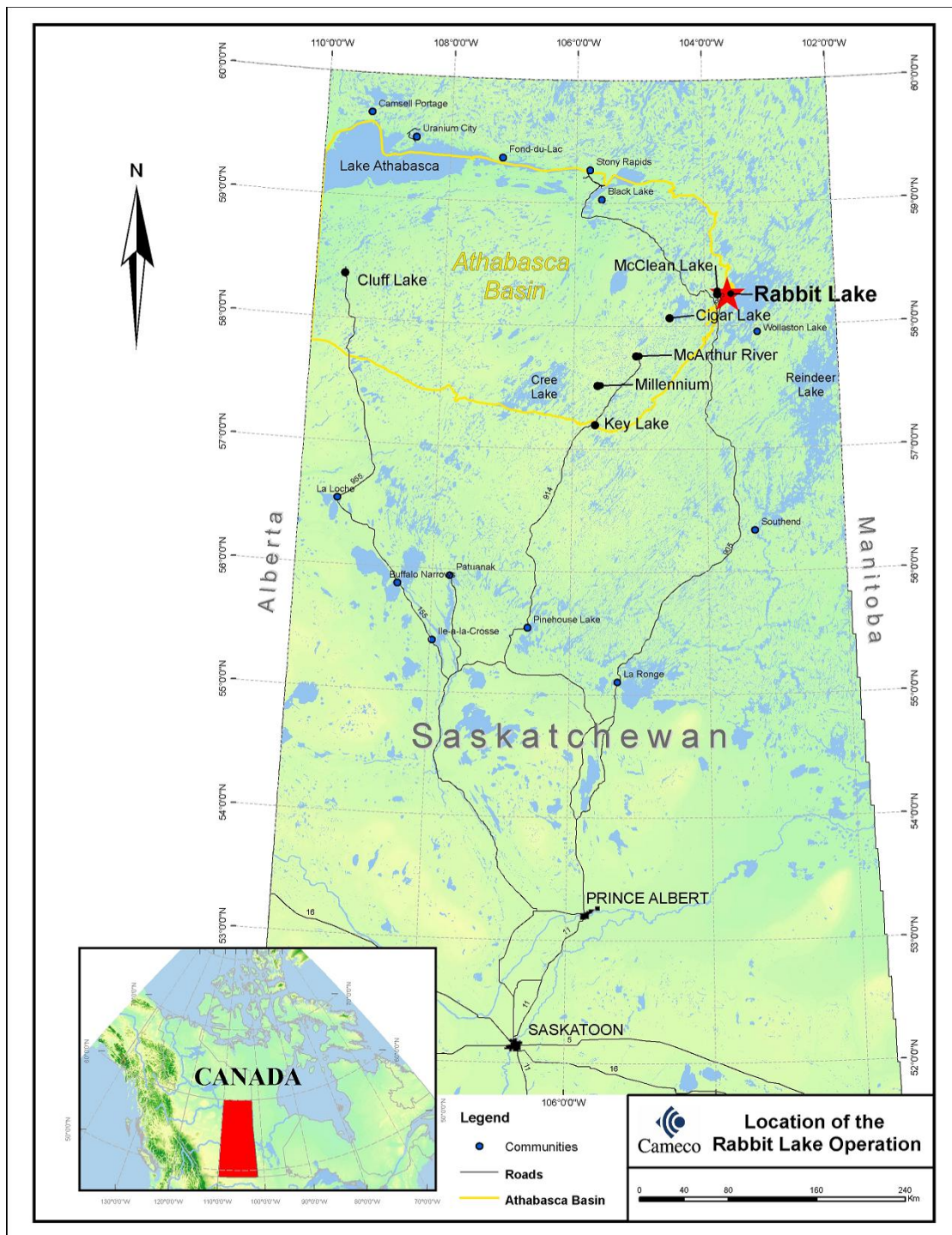
(Cameco Corporation, 2010)

2.4 Rabbit Lake Location

Rabbit Lake is located approximately 750 km north of Saskatoon, Saskatchewan, on the west end of Wollaston Lake. Access to the site is via a gravel road off Provincial Road 905 or by air, as a landing strip has been constructed on site. The Eagle Point mine is approximately 15 km north of the Rabbit Lake mill.

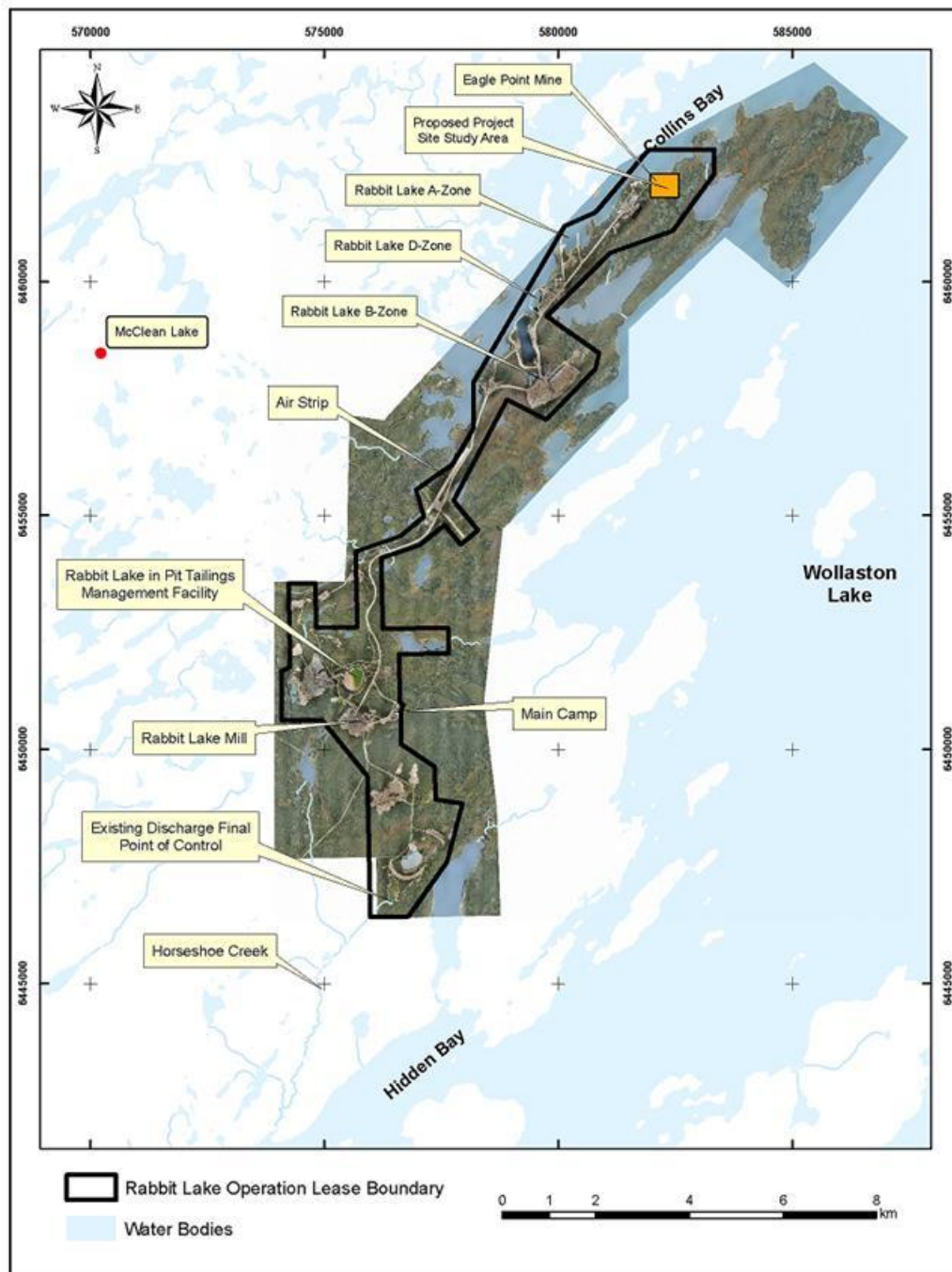
Several communities are located relatively close to the operation, the nearest being the Northern Settlement of Wollaston Lake. Other impacted communities within the Athabasca Basin include Black Lake First Nation, Hatchet Lake First Nation, Fond du Lac First Nation, Northern Settlement of Uranium City, Northern Settlement of Camsell Portage, and the Hamlet of Stony Rapids. The Rabbit Lake operation is also in fairly close proximity to the AREVA Resources Canada Inc. (AREVA) McClean Lake operation.

Figure 2-5: Location of the Rabbit Lake Operation



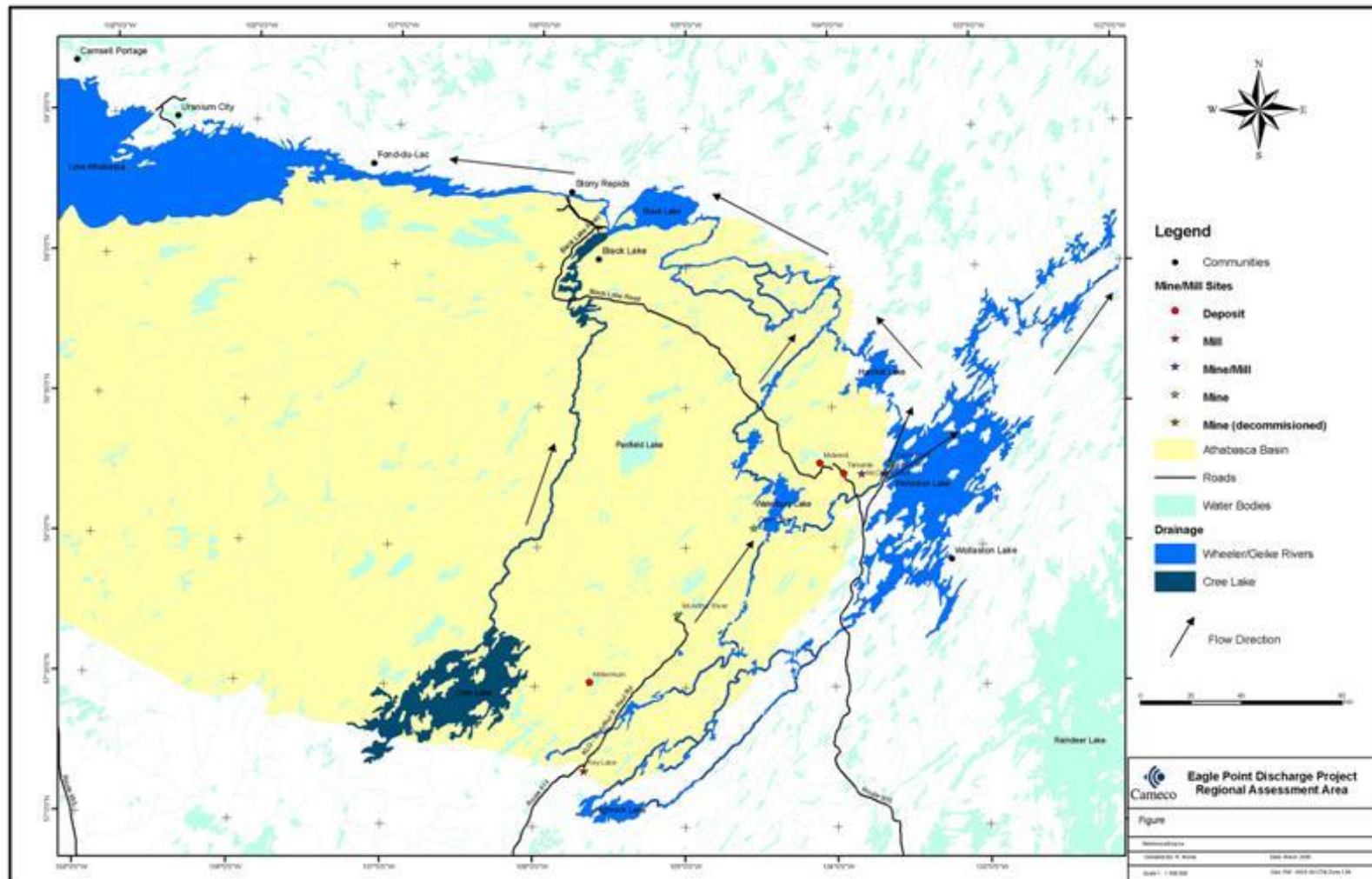
(Cameco Corporation, 2010)

Figure 2-6: Aerial View of the Rabbit Lake Operation



(Cameco Corporation, 2010)

Figure 2-7: Athabasca Basin Communities and Bodies of Water

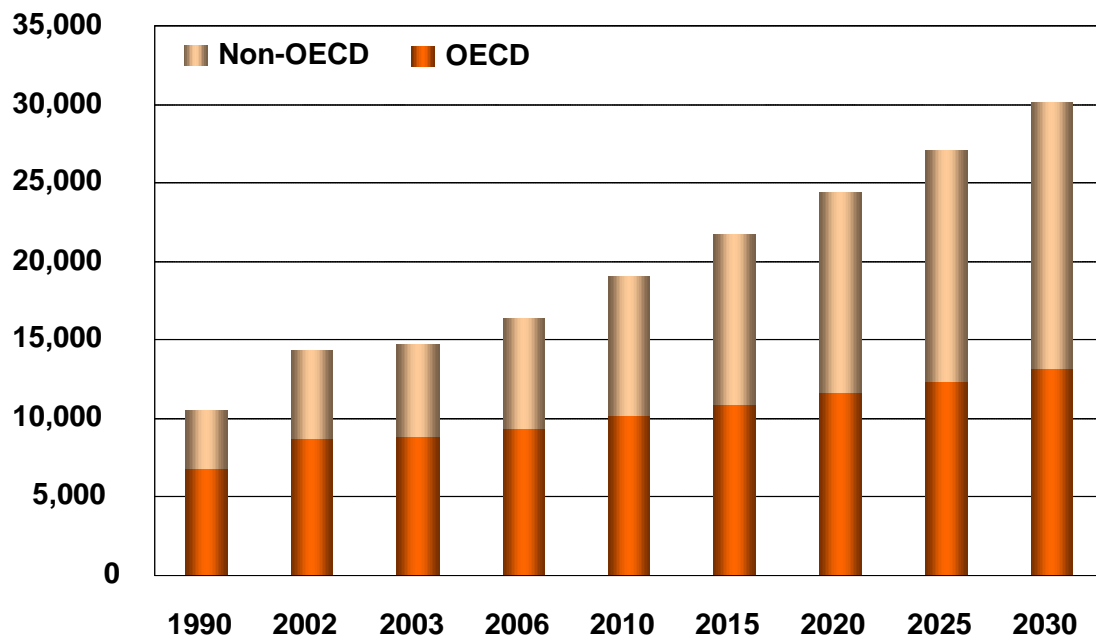


(Cameco Corporation, 2010)

3: Industry Analysis

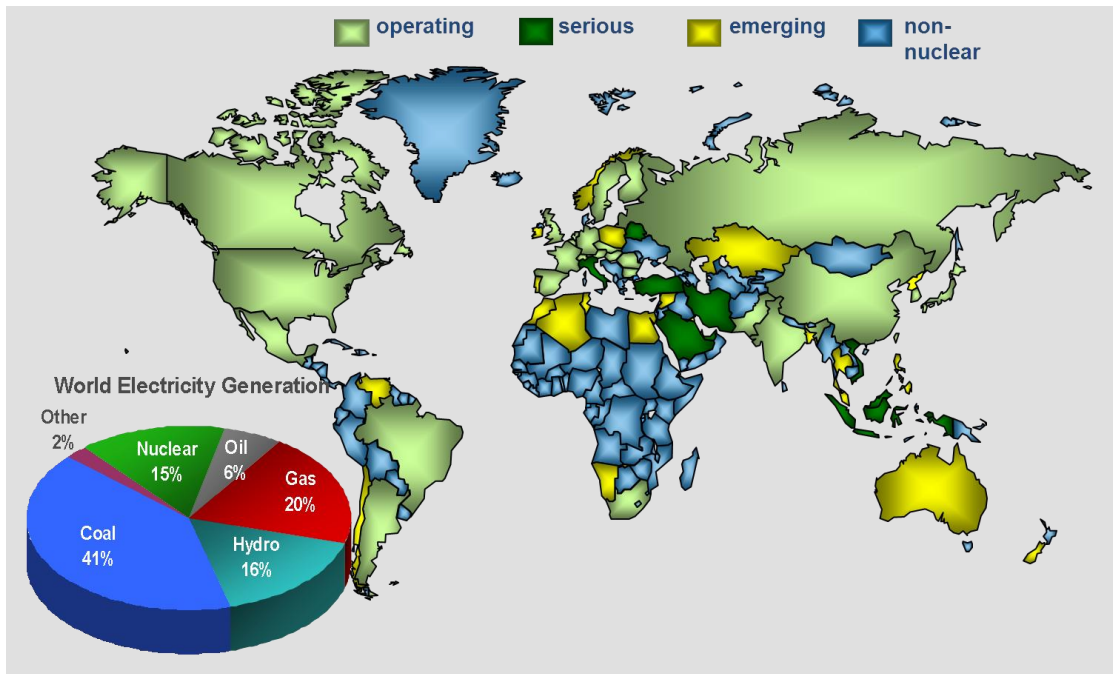
World demand for electricity has almost doubled since 1990 (Figure 3-1) and is expected to triple by 2030 (International Energy Outlook, 2010). This demand surge is primarily driven by developing countries, such as China and India. Almost two thirds of world electricity is generated by fossil fuels — coal, gas, and oil — while the remainder is generated by hydro, nuclear, wind, sea, and solar. Nuclear energy has a key role in meeting world demand for electricity and currently accounts for 15% of world electricity generation (Figure 3-2). There are currently 438 nuclear units operating in 30 countries. These units require about 180 million pounds of uranium to operate annually. Today the nuclear industry generates more global electricity than was produced, in total, in the 1950s. This section of this report will look at the nuclear industry history and uranium mining and milling.

Figure 3-1: World Net Electricity Consumption (in billions of kWh)



(International Energy Outlook, 2010)

Figure 3-2: World Electricity Generation by Nuclear Power

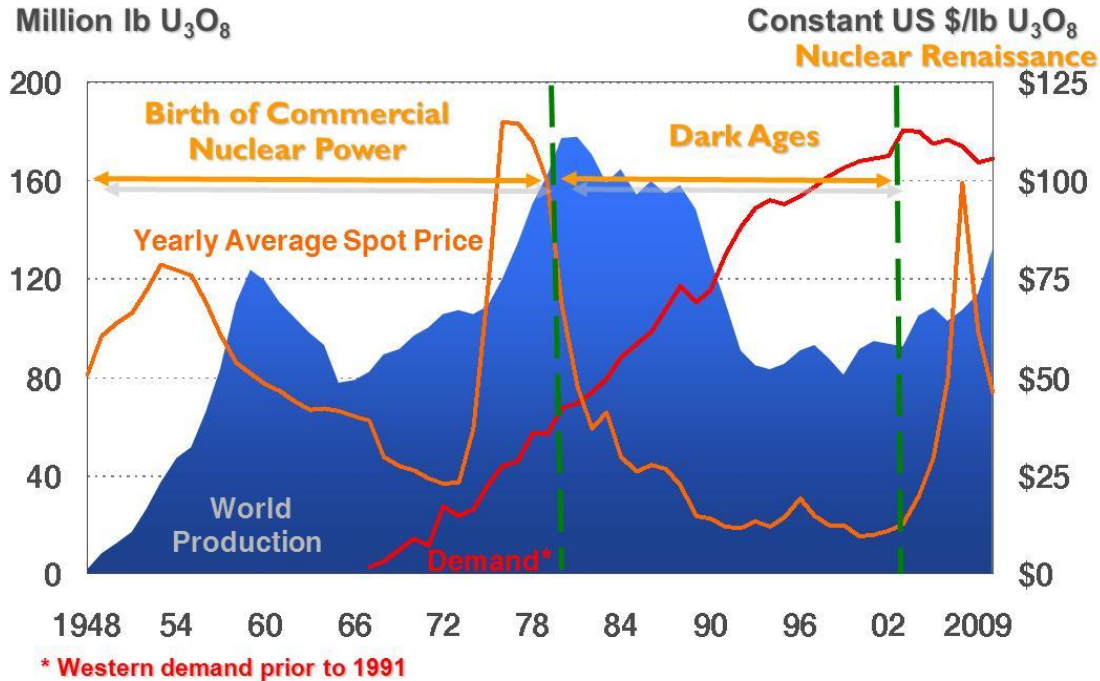


(Cameco Corporation, 2010)

3.1 Nuclear History 101

The history of the nuclear power industry can be separated into three distinct phases. The first phase is the “Birth of Commercial Nuclear Power”, when the world had grand plans for nuclear power and was expected to build over 1000 reactors. The second phase is the “Dark Ages”, when the wheels started to fall off the nuclear bandwagon. Finally, the third phase is the “Nuclear Renaissance”, when nuclear power is once again bright and opportunities abound. Figure 3-3 illustrates these three distinct phases.

Figure 3-3: Uranium Production vs. Demand



(Cameco Corporation, 2010)

Prior to the 1950s, uranium production was driven by the nuclear arms race. Governments sought stable supplies for their weapons programs and provided substantial resources to encourage new production. The US Atoms for Peace initiative changed the military motivation once the realization that nuclear energy could be used for power generation gained traction. The commercial uranium heyday lasted from 1950 to 1979, characterized by the “Too Cheap to Meter” nuclear boom, also known as the “Great Bandwagon Market”. There was an expectation that 1000 nuclear power plants would be built, This did not occur, and today only 438 reactors are operating in the world. During the heyday era many utility companies adopted self-supply strategies, which included exploration and mining. This strategy was based on utility companies’ fears of being left with a reactor and no fuel, as most supplies of uranium were being secured even before the nuclear plants were ordered. This is illustrated in Figure 3-3, the blue production curve exceeding the red demand curve based on that optimism. Nuclear power did grow dramatically worldwide over this period, but much less than the predictions, and this caused the industry to produce far more uranium than would be needed by the world’s nuclear reactors. It is this development, and the huge military build-up of inventories that preceded it, which would set the stage for twenty years of inventory drawdown. Figure 3-3 also show very clearly the direct relationship between high uranium prices and expansion of production, and that there is a long lag

between price increases and significant production increases. The uranium prices during this time exceeded \$100 per pound.

The “Dark Ages” of the nuclear power industry started in the 1980s, largely as a result of incidents at nuclear power plants in Chernobyl and Three Mile Island. These incidents inflamed public opposition and as a result regulatory oversight increased dramatically and existing plant designs had to be re-engineered. High interest rates of the 1980s combined with new stringent regulations and re-engineering designs caused the costs of new reactors to skyrocket to unacceptable levels. Many projects were abandoned at various stages of design and construction. In the 1990s, as result of deregulation of the electricity market, many utilities questioned the competitiveness of nuclear power plants compared with quick to build and cheap to operate natural gas power plants. It was expected many reactors would not even operate to the end of their license lives and that the nuclear power industry was doomed. Uranium prices fell below \$10 per pound as a secondary market emerged. Uranium brokers sought out excess or unneeded uranium from nuclear utility plants and sold it to willing buyers at deeply discounted prices. This inventory driven era caused uranium prices to depress and disconnect from their relation to the production economics of uranium mining. As a consequence, many operating mines simply shut down. Uranium production fell from 177 million pounds in 1982 to 81 million pounds in 1999 (Figure 3-3). Many uranium companies left the business, and the remainder consolidated into larger companies. In 1998 six major companies accounted for more than 70% of worldwide uranium production.

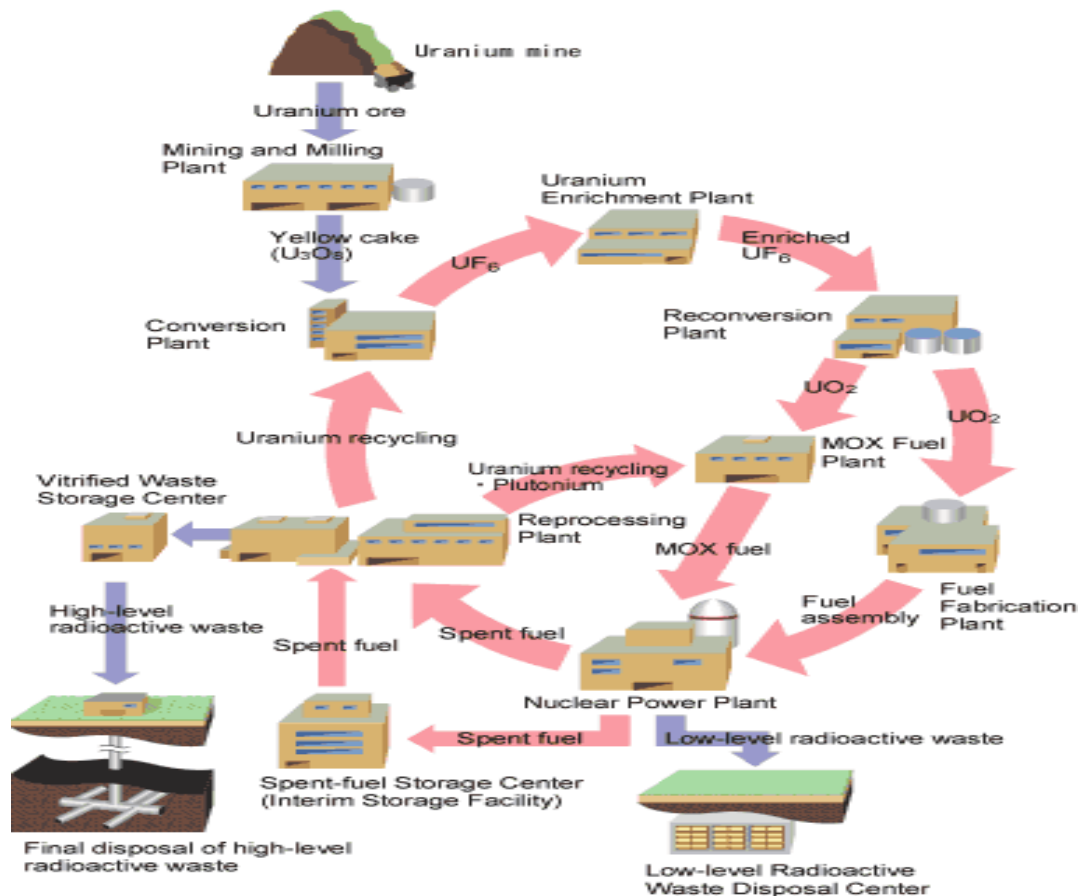
Over the past decade nuclear renaissance has occurred, primarily due to three factors. The first factor relates to improved efficiency and performance of nuclear power plants over the years. This has caused nuclear power utilities to become the lowest cost base load power utilities. The second factor relates to climate change and public awareness of the shortcomings of coal and the clean air advantages of nuclear power. It has been noticed that nuclear power had a key role to play in reducing greenhouse gases. For example, in 2009 the use of nuclear power prevented emissions of about 2.5 billion tonnes of carbon dioxide (Nuclear Energy Institute). The third factor relates to Middle East conflicts, which have contributed to high oil prices. Many countries have focused on the development of domestic supplies because of a concern about the security of energy supplies. Demand for uranium has increased dramatically owing to existing nuclear power utilities increasing their capacity and extending their operating licenses. This has further progressed to license applications for new nuclear reactors. This in turn has been very good news

for uranium mining companies, as it gives them the confidence that return on their large capital investments will be high.

3.2 Uranium Mining and Milling

The entire nuclear fuel cycle (front end, reactors, and back end) is illustrated in Figure 3-4. The first step in the nuclear fuel cycle is the mining and milling of raw uranium ore to produce yellowcake (U_3O_8). Mining and milling uranium is a key activity, and it has experienced a major growth in the past few years in anticipation of future uranium supply/demand requirements.

Figure 3-4: Nuclear Fuel Cycle



(UxC, December 2010)

3.3 Future Uranium Supply and Demand

Looking to the future, Cameco expects the use of nuclear power to expand. Over the next 9 years, Cameco anticipates 108 new reactors worldwide. Over the same time period, 19 reactors are expected to be shut down, so the forecast includes 527 reactors operating by 2019, a net increase of 89 reactors from today. As can be seen in Table 3-1, the largest growth area is in Asia. In China, Cameco expects 42 new reactors by 2019. More than 20 reactors are currently under construction, and dozens more are planned. Some reports have China targeting 80 Giga-Watt (GWe) by 2020, which is almost 9 times its current capacity. In contrast, the Cameco forecast that China will reach 60 GWe by 2020 is a bit conservative. Another large growth area is India, where Cameco expects 12 new reactors to come on line over the next 10 years. India has stated that its goal is to have nuclear capacity rise to 21 to 29 GWe by 2020. Cameco again assumes 16 GWe by 2020, again being on the conservative side. In the rest of Asia — Japan, South Korea, and Taiwan — it is expected there will be 18 new reactors.

Table 3-1: New Build outlook - Planned Reactors

Regions	Operating	New	Shutting Down	Operating 2019	Change
Americas	128	9	2	135	7
Europe	148	8	8	148	0
Asia	80	18	1	97	17
India	19	12	0	31	12
Other*	4	5	0	9	5
Russia & E. Europe	48	14	8	54	6
China	11	42	0	53	42
Total	438	108	19	527	89

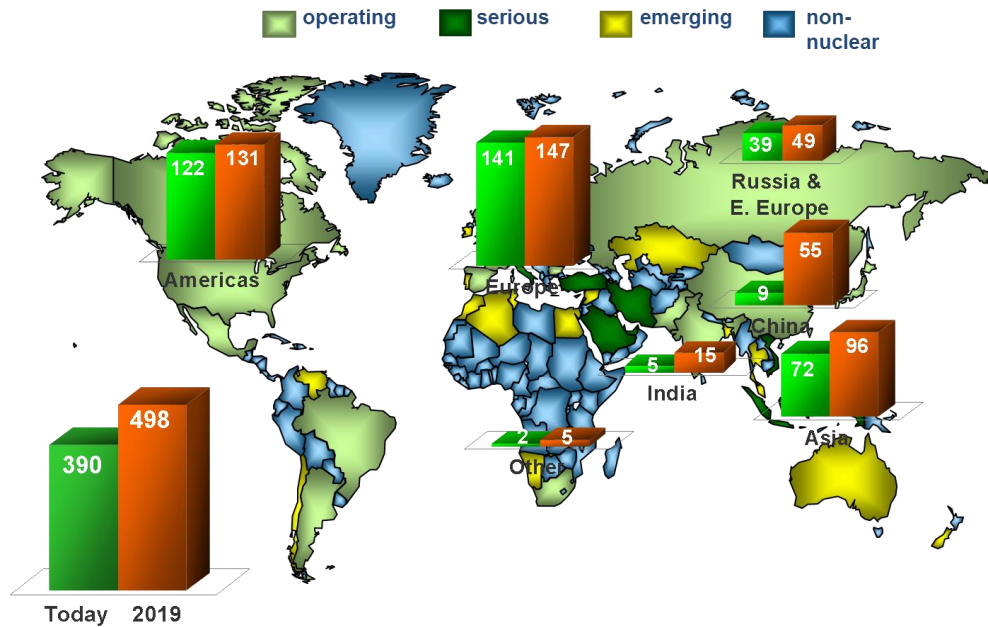
**Other includes Iran, Pakistan, South Africa, United Arab Emirates*

(Cameco Corporation, 2010)

The 527 operating reactors forecast for 2019 translates into nuclear capacity of 498 GWe, which is a 28% increase from today's 390 GWe (Figure 3-5). The nuclear renaissance has

provided numerous opportunities, with more than 30 currently non-nuclear countries actively considering embarking upon nuclear power programs over the next 20 years. Those included in the 10-year forecast are Belarus, Iran, Italy, and the United Arab Emirates.

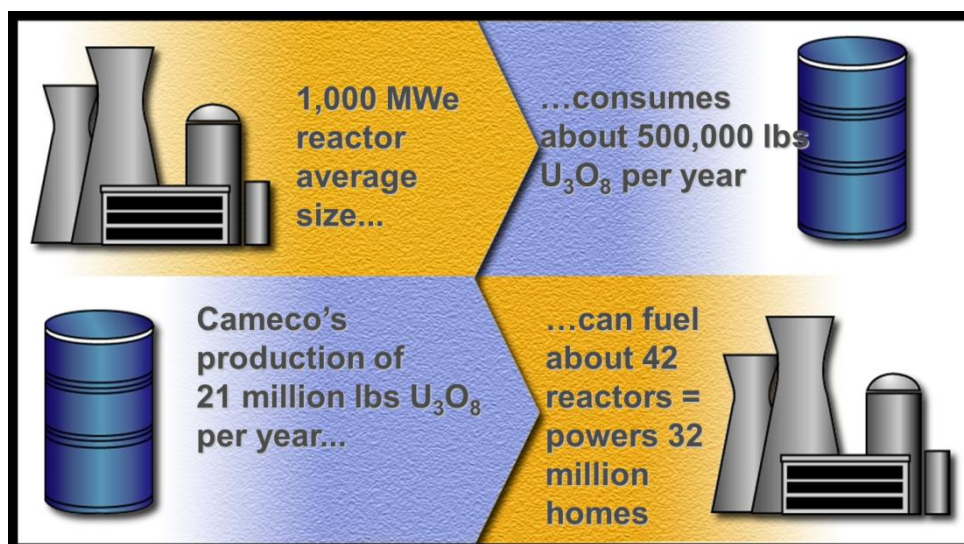
Figure 3-5: New Build Outlook - Gross GWe



(Cameco Corporation, 2010)

The nuclear generating capacity forecast, combined with assumptions about how reactors are operated, gives a forecast of world demand for uranium. A 1000 MWe reactor can provide electricity for about 760,000 homes on average and requires about a half a million pounds of uranium a year (Figure 3-6). This compares to 3.5 million tons of coal, 12 million barrels of oil, or 77 billion cubic feet of natural gas. To provide some context, Cameco's 2010 share of uranium production could fuel 42 reactors, providing enough power for 32 million modern homes.

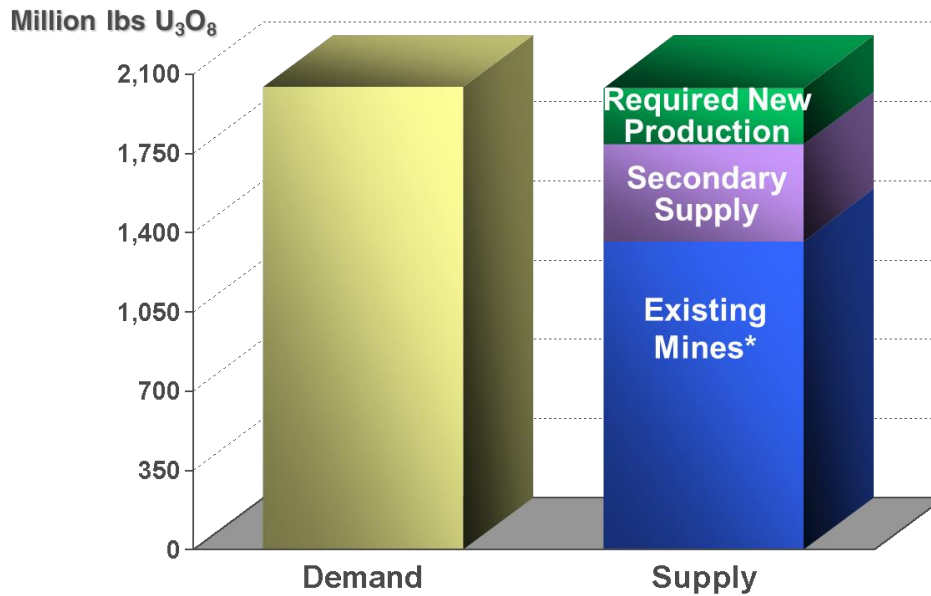
Figure 3-6: Fuel Conversion



(Cameco Corporation, 2010)

The yellow bar in the Figure 3-7 represents the worldwide demand for uranium based on the needs of existing reactors and the projected requirements of reactors planned. The overall demand is expected to be a little over 2 billion pounds of uranium by 2019, increasing from about 180 million pounds today to 233 million pounds (almost 30%) by 2019. The increase in demand provides many opportunities for uranium producers and is very welcome after the years of stagnant or decreasing demand. While the demand forecast (Cameco, 2010) assumes a dramatic increase, there is likely more upside than downside because of the conservatism built in around new reactors in China and India.

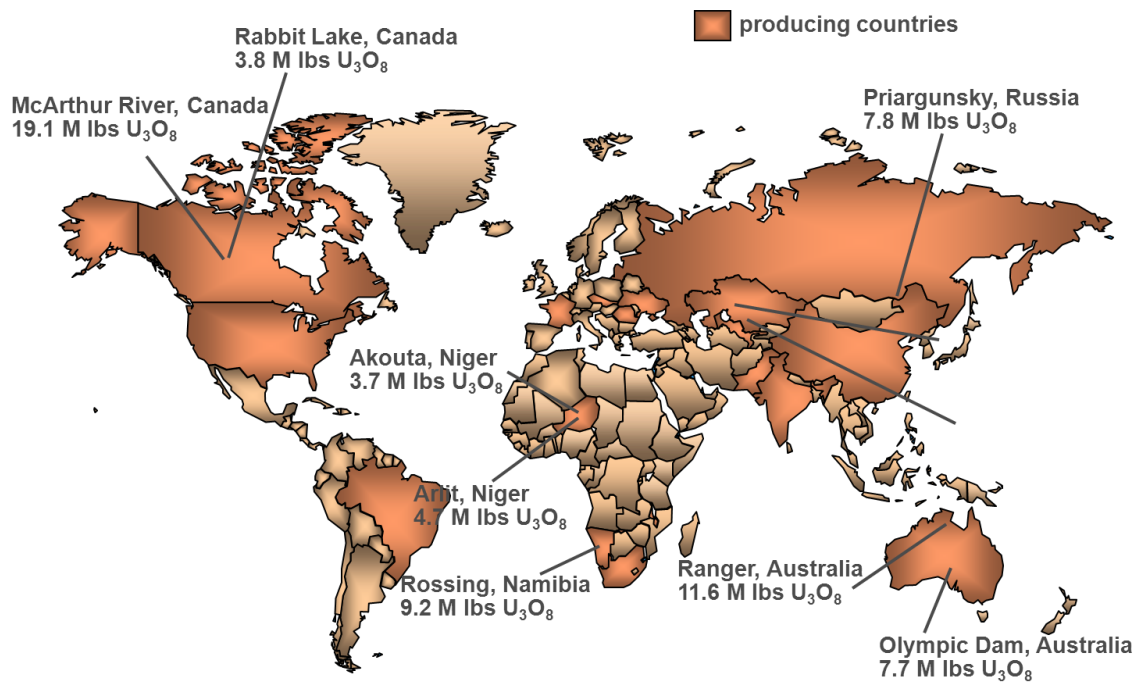
Figure 3-7: Future Uranium Supply/Demand 2010-2019



(Cameco Corporation, 2010)

The supply and demand scenario, Figure 3-7, shows production from existing mines; Figure 3-8 provides a perspective on the locations of existing uranium production. In 2010, there were about 45 existing production centers in 16 countries. As a result of the historic depressed prices, generally only very large mines are economic, and 59% of the world uranium production in 2010 came from 10 mines. The large scale of these mining operations is certainly a source of their competitive strengths, but may also present challenges to the overall market when or if production interruptions occur.

Figure 3-8: Existing Mines-10 Largest in 2010



(Cameco Corporation, 2010)

The existing mines, which include all mines in commercial operation at the end of 2010, are assumed to produce at or near their stated capacity levels until current reserves and resources are depleted or until an announced closure date. It is expected that, over the next decade, about 1.4 billion pounds will be supplied by existing production centers, meeting 67% of demand in that time frame.

The production does not meet demand, and thus secondary supplies are required to bridge the gap. The most significant sources of secondary supply over the next decade include US and Russian government inventories as well as the use of mixed oxide fuel (MOX) and reprocessed fuel. The end of the Cold War resulted in both the US and Russian governments having excess inventories, and since 1993 Russian weapons have been dismantled and the uranium contained made available to the commercial nuclear fuel market under the Russian highly enriched uranium (HEU) agreement. The agreement will run through 2013 and supply about 20 million pounds per year in that time frame. The US government also has excess inventories amounting to about 150 million pounds, and it plans to make this available to the market at a rate of around 5 million pounds per year, starting as early as 2011.

Another significant source of secondary supply is the use of MOX and reprocessed fuel. A few utilities in Europe, Japan, and Russia recycle their used fuel, in part to decrease the volume

of high level waste storage required, and this means they will require less uranium in the future; this is shown in Figure 3-7 as a supply source. The forecast assumes that the use of these fuels will increase over time, as many countries struggle with how to deal with nuclear waste, and it assumes about 90 million pounds from this source over the next 10 years. In total, it is expected that the consumption of secondary supplies will amount to over 400 million pounds over the next decade and meet about 21% of demand. The use of secondary supplies is expected to decrease annually from about 50 million pounds per year to less than 30 million pounds per year, largely as a result of the ending of the Russian HEU agreement in 2013.

Comparing the supply sources to demand (Figure 3-7) over the next decade shows us that about 250 million pounds of new supply sources will be required as the drawdown of secondary sources can make up only a portion of the cumulative production deficit from existing mines. It is expected this new supply will come from new production centers. This will be challenging, but it is expected that the demand will be met by current production increases.

3.4 Market Overview

For a long time the nuclear power utilities have relied on low-cost secondary inventory sources of uranium supply, both commercial and military in origin, to fuel their reactors. This reliance caused the spot price of uranium to drop dramatically. In recent years the spot price of uranium has appreciated over 1800%; in January 2001 prices were at \$7 per pound of U_3O_8 and in July 2007 they were at a high of \$136 per pound. This is largely due to depletion of secondary inventory sources as the market anticipates a revival in uranium demand. Even though the spot price of uranium has since dropped considerably (\$62 per lb, Dec 2010), interest in the commodity remains strong. This recent drop in the spot uranium price is a direct result of increased exploration and new mine development activity, itself a market response to the demand for more primary production. However, it should be noted that uranium is traded with long-term contracts at above \$62 per pound of U_3O_8 (Cameco Corporation, 2010).

In the past few years, there has been increased capacity at existing nuclear power plants, extension of plant licenses, and new plant constructions, as electricity demand has risen worldwide. For example, in China, there are currently 11 reactors and 19 more in the construction phase. There are plans to build 90 more reactors in China by the year 2020 to meet China's energy demands (UxC, March 2010). In India there are plans to increase the nuclear power generation to 18,000 MW by the year 2020 and over 35,000 MW by the year 2030 (UxC, March 2010).

Public perception in many countries is slowly changing in favour of nuclear power. This is due to natural gas and oil prices, which have made nuclear energy a much lower cost option. In addition, global warming concerns have increased support for an interest in nuclear power generation.

The 2008 annual worldwide uranium demand was estimated at 180 million pounds of U_3O_8 , while uranium production was only 113 million pounds of U_3O_8 (UxC, March 2010). The shortfall between the demand requirements and production supplies was covered by several secondary sources, including excess inventory held by utilities, producers, high-enriched uranium from Russian nuclear weapons, and reprocessed uranium and plutonium derived from used fuel. These secondary sources continue to decline in importance as recovered uranium from nuclear weapons and excess inventories are progressively consumed into the early part of the next decade, thus resulting in the need for even more primary mine supply.

Nuclear power utilities have started to understand that low-cost inventories can no longer be relied upon and they must build sound working relationships with primary producers in a manner that supports economically viable production operation over the long term. Recent events at major producing mining companies (floods at McArthur River and Cigar Lake, a tropical cyclone at Ranger, and a haulage accident at Olympic Dam) have further established that low-cost production is not a given and the need for nuclear power utilities to make sound working relationships with primary producers, i.e., mining companies, is necessary (UxC, December 2010). By making sound working relationships, the utilities protect themselves against spikes in uranium spot prices due to the effects of accidents and flooding of major uranium mines.

As numbers of major producers hold significant shares of world uranium production through mega-projects, an incident at one of these mega-project production facilities can have a lasting impact on the market. For example, the flood at Cigar Lake has postponed the production of the world's largest and richest uranium mine by more than six years. Another example is the haulage accident at the Olympic Dam mine, which caused production to be reduced by 75% over several months. The spot prices in each case reflected these incidents, jumping up several dollars. Appendix A illustrates other major events and their effects on uranium spot price (UxC, December 2010).

3.5 Key Players

The key players in the uranium market are producers, secondary suppliers, buyers (primarily nuclear power utilities), and middlemen (brokers, traders, transportation companies).

The key source of supply in the future is the very large mining companies which currently control 82% of the world's total uranium production. A list of the top seven companies with their global share (approximation) of current production is given in Table 3-2.

Table 3-2: Key Uranium Suppliers

Rio Tinto Uranium	18%
Cameco Corporation	15%
AREVA	15%
NAC Kazatomprom	13%
ARMZ (Russia)	8%
BHP Billiton	8%
NavoiMMC (Uzbekistan)	1.2%

(UxC, December 2010)

As mentioned previously, the uranium industry is dominated by a small number of mega-projects and mega-producers. With the increase in uranium prices and the expected long-term high demand for uranium, numerous smaller new entrants are coming into the market. As the result, the global share trend is slowly changing. Some of these smaller producers are Denison Mines, Nufcor (Anglogold Ltd.), Uranium Resources, Inc., General Atomics (Beverley), Uranium One, Paladin Resources, and Mestena Inc.

3.6 Michael Porter's Five Forces

Michael Porter's five forces (1979) is a competitive position model theory that is used to assess and analyse the competitive strength and position of a corporation or business organization (Business Balls, 2011). The first force is existing competitive rivalry among suppliers. Next is the threat of new market entrants. The third force is the power of suppliers, followed by bargaining power of buyers. Last is the threat of substitute products. The following subsections will describe each of these five forces in detail. Finally, a summary of the five forces will be given.

3.6.1 Existing Competitive Rivalry among Suppliers

As described earlier there are only a few major producers in the uranium industry. There is minimum direct rivalry among these major producers as each key producer competes against production costs and the selling price of uranium. This is largely because competition in the uranium industry is cost based. The high-cost/smaller producers (mines/mills) enter the market only when uranium prices are high (demand exceeds supply). When supply exceeds demand (i.e.,

excess in uranium inventory), the price of uranium drops and the smaller uneconomical producers either exit the market or consolidate with other producers to lower their cost of production in order to compete in the industry. Even though there is minimum direct rivalry amongst producers, there is some indirect rivalry. One example of this indirect rivalry is the attempt by firms to lower their operating costs to better compete and stay in the market. The more costs incurred by operations, the higher the risk of shutting down, which in turn affects the supply–demand equilibrium. Finding larger or higher grade ore bodies also has the potential of forcing other high-cost producers out of the market. However, these ore bodies are not an immediate threat, as it takes years to develop them and bring them to production.

3.6.2 Threat of New Market Entrants

The threat of new entrants is relatively low in the uranium industry because there are numerous barriers for a new entrant. Capital investments for a new mine and mill are in the range of billions of dollars. This minimizes the opportunity for small producers to enter the industry unless the price of uranium is high enough. Another barrier to entry is the regulatory licensing regime. Uranium mining and milling is one of the most regulated industries in the world. It takes years, if not decades, to receive a license to operate.

3.6.3 Power of Suppliers

The bargaining power of suppliers is medium to high, depending on the mining industry peak. Commodities such as chemicals, fuel, and electricity used in the production of U_3O_8 follow predictable commodity pricing trends (Graden, 2006). As such there is very little buying power for uranium producers. The location of uranium mines means that uranium producers have very little bargaining power in purchasing mining equipment and replacement parts. The mining industry uses mostly large and specialized equipment that is available from only a few key suppliers. Obtaining skilled labour is also dependent on the location of the mine and the peak of the industry. The higher the peak of the mining industry, the lower the availability of skilled labour. Also, the more remote the mine, the fewer skilled workers are found. The higher the spot price of uranium, the more bargaining power exploration companies or junior mining companies have over selling ore bodies to key uranium producers.

3.6.4 Bargaining Power of Buyers

The bargaining power of buyers depends on the supply and demand equilibrium. The more primary sources of uranium there are, the more bargaining power the utilities have over uranium producers. Secondary sources such as excess inventory held by utilities, highly enriched uranium from Soviet-bloc nuclear weapons, and reprocessed uranium and plutonium derived from used fuel also affect the bargaining power of the utilities. The bargaining power of utilities also depends on the efficiency of nuclear reactors; the more efficient a nuclear reactor, the less fuel it requires. During the existing “Nuclear Renaissance” phase the bargaining power of buyers is low to medium.

3.6.5 Threat of Substitute Products

The threat of substitutes is medium to high when there are alternative energy sources for electricity, such as wind, gas, biomass, and run of the river. No uranium fuel is required if nuclear plant utilities are replaced by the alternative energy sources. This threatens the demand for uranium in the market as current inventory levels increase.

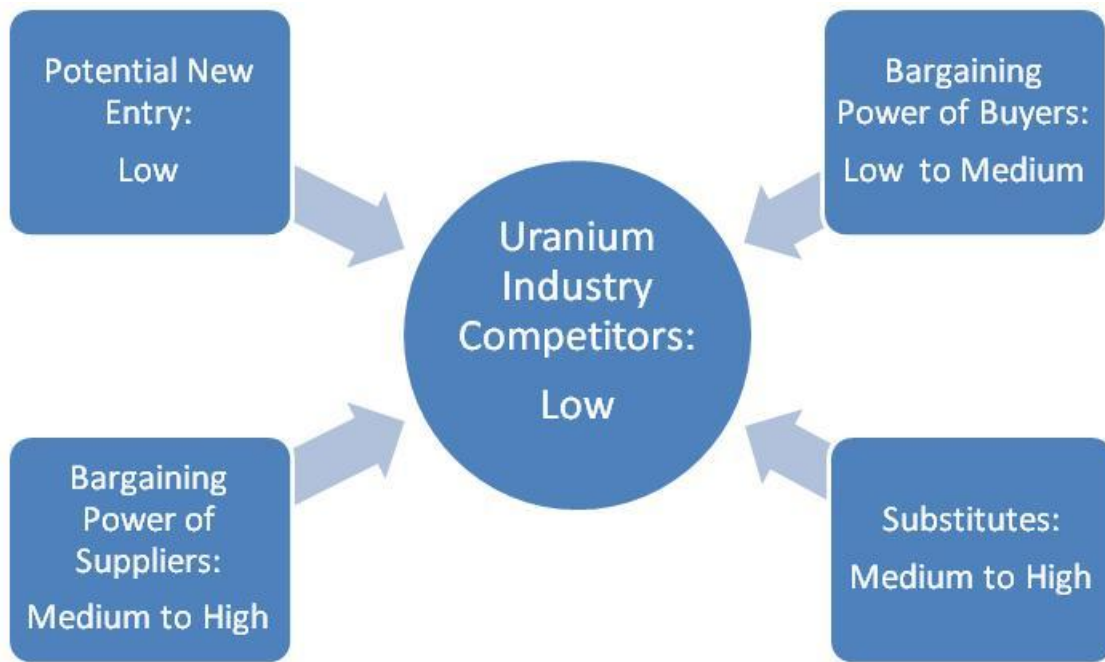
3.6.6 Regulators and Complementors

The success of the uranium mining industry will also be dependent upon the support of other key stakeholders, such as the local communities, governments, and regulators. The uranium industry has a responsibility to operate under the highest standards of environmental stewardship, safety, and ethical integrity. In turn, it expects reasonable policy and regulation from the governing bodies which balances the right to earn a profit for shareholders while conducting the business in the best public interest possible.

3.6.7 Summary of Michael Porter’s Five Forces

Figure 3-9 summarizes Michael Porter’s five forces (1979) and their impact on the uranium industry during the existing “Nuclear Renaissance” phase, when the future of nuclear power is once again bright and opportunities abound. The attractiveness of the uranium industry changes once we move out of this phase. Overall, direct competition in the uranium industry is low, while there is some indirect competition. The bargaining power of suppliers to the industry is medium to high, while the bargaining power of buyers is low to medium. Potential new entry to market is low. The threat of substitutes is medium to high as new alternative energy sources for electricity become more efficient.

Figure 3-9: Porter's Five Forces - Uranium Industry



The uranium mining industry is rising to the challenges of the nuclear renaissance, and the fuel cycle will continue to be one of its greatest advantages. It will, however, be the product of significant investment (millions if not billions), risk-taking, and hard work among the world's uranium miners. It will also be a product of the foresight of strategic nuclear utilities that forge strong relationships with their suppliers and provide the base load contracts that allow this level of investment to move forward. In closing, while the uranium market is rapidly moving into a new phase of growth, it presents a whole new set of challenges and uncertainties.

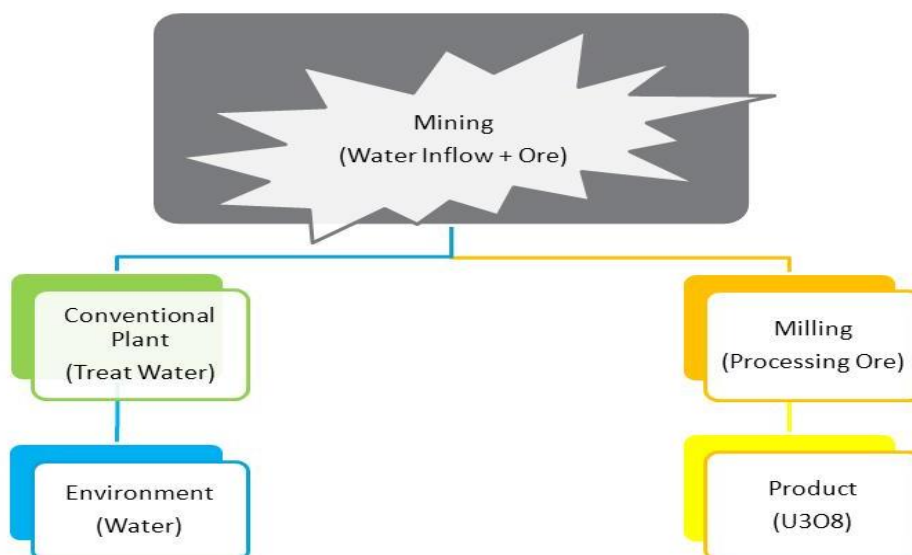
4: Value Chain

Limited capacity at the Rabbit Lake mill to process effluent from the Eagle Point mine is threatening to shut down the mine, even though there is additional ore available. If the mine shuts down, the Rabbit Lake mill will have to shut down as well and go to care and custody until the Cigar Lake mine is commissioned in 2016. These two scenarios; no RO plant versus an RO plant, will be compared and analyzed here to demonstrate which scenario is more attractive in making the Rabbit Lake operation more competitive in the overall uranium market.

4.1 Existing Value Chain

Figure 4-1 presents the existing value chain from an Eagle Point mine perspective. Eagle Point adds value in the uranium industry by further developing and increasing production. To do this, the current environmental impact must be either kept stable or reduced as part of regulatory compliance. Further development of the underground workings will increase water inflows (effluent) that must be treated. Currently, all the effluent from the Eagle Point mine is pumped to the conventional chemical treatment plant located at the Rabbit Lake mill, a distance of 15 km away. The conventional chemical treatment plant can treat only a certain volume of effluent. Additional volumes will force mine development and production to cease until all the effluent has been treated. Moreover, the ability of the conventional chemical treatment to remove contaminants down to minute concentration is limited. More effluent treated in the conventional chemical treatment will mean more metal loadings (pollutants) to the environment.

Figure 4-1: Existing Value Chain



The conventional chemical treatment plant at Rabbit Lake is made up of three circuits and two intermittent clarification stages. The low pH treatment (LPT) stage is the first step in the process, which consists of four Pachuca tanks. Effluent from the mine, raise water from the tailings pit, and acidic solutions from the uranium milling process are fed to the LPT circuit. Initially the pH of the combined stream is in the acidic range (~2.0). Lime and ferric are systematically added to the Pachucas in stages, effectively bringing up the pH while causing some of the dissolved metals such as arsenic, molybdenum, and selenium to precipitate. The mixed precipitated metal in solution then leaves the LPT circuit and enters the low pH clarifier (LPC), where the precipitated metals are allowed to settle out with the addition of flocculants. The now clarified liquid that leaves the LPC is fed into the high pH treatment (HPT) circuit.

The HPT consists of three large tanks where lime is again added in stages to bring the solution in the last tank into the basic range (pH ~ 11.0). This high pH range is necessary to precipitate other dissolved metals, such as uranium and nickel that did not precipitate in the LPT circuit. The solution then continues on to the last clarification stage in the high pH clarifier (HPC). The solids are allowed to settle out with the addition of flocculants, and the clarified solution continues on to the last stage.

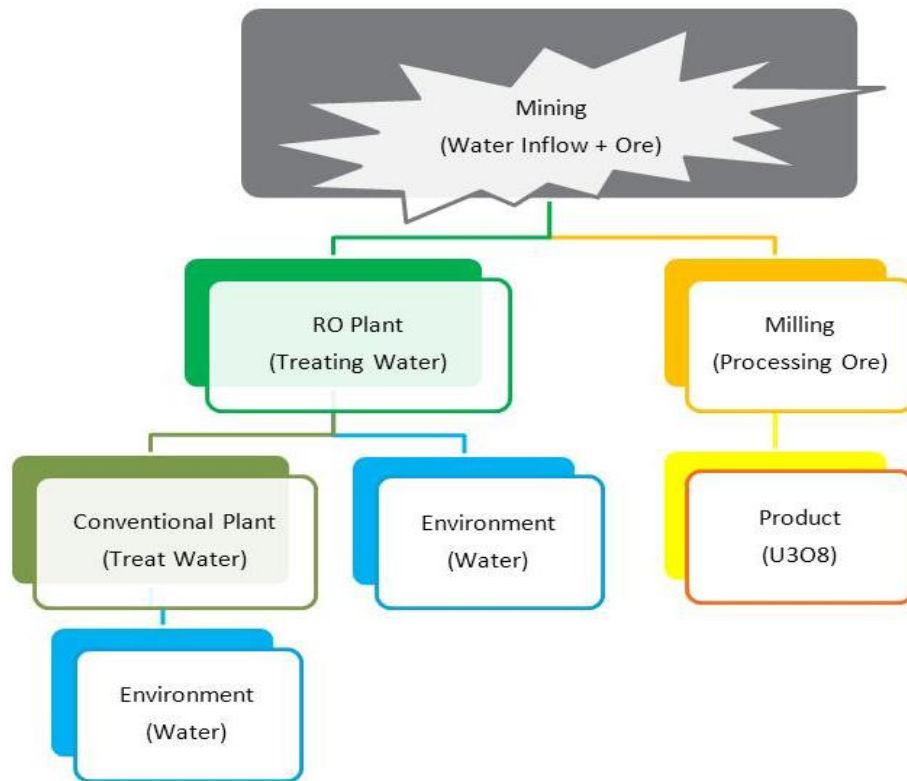
The final pH treatment stage is the last in Rabbit Lake's conventional chemical water treatment plant. Use of a combination of acid and lime brings the pH of the solution down to a neutral pH (~7.0) before it is released to the environment.

In 2006, changes to the conventional chemical plant were implemented to increase the capacity of the mill circuits. A new building containing water treatment equipment was constructed along with a new 3 million litre clarifying tank. This option was very expensive, costing upwards of 60 million dollars. This demonstrates how expensive it is to increase capacity at the mill. Reducing effluent volume is the next option to consider.

4.2 New Value Chain

Figure 4-2 demonstrates how the value chain from the perspective of the Eagle Point mine will change by addition of an RO plant. Treatment of the excess water by the RO plant is expected to result in a further reduction, from the levels experienced historically at Rabbit Lake, in all constituents of potential concern (e.g., arsenic, molybdenum, nickel, selenium, uranium) that report to the final effluent. This in return will allow the Eagle Point mine to develop further and eventually increase production.

Figure 4-2: New Value Chain



Because of the planned expansion of the Eagle Point mine production, the mine water generated is expected to increase by 2 m³ per 10 m of mine development. Thus, more water treatment capacity is needed. The best and worst case inflow scenarios are estimated based on the historical inflows per metre of mine development. A contingency factor of 50% is then used to calculate the required additional line capacity.

Table 4-1 gives the expected inflows and the required additional line capacity through to 2018. The best and worst case inflow scenarios are estimated based on the historical inflows per metre of mine development. A contingency factor of 50% is then used to calculate the required additional line capacity.

Table 4-1: Water Inflow Predication

Year	Baseline inflow prediction			Normal Operating Requirements	
	Estimated Annual Development (m)	Inflow Rate (m ³ /h) Best Case ^a	Inflow Rate (m ³ /h) Worst Case ^b	Inflow Rate + 50% (m ³ /h) ^c	Required additional line capacity (m ³ /h) ^d
2010	4450	297	297	446	110
2011	4980	339	339	508	62
2012	3880	329	371	556	110
2013	3000	354	396	594	148
2014	3000	379	421	631	185
2015	3000	404	446	669	223
2016	1500	304	458	688	242
2017	500	308	463	694	248
2018	500	312	467	700	254

(Cameco Corporation, 2010)

^aUnderground water reduction efforts successful.

^bUnderground water reduction efforts not effective or feasible.

^cCameco standard of having >50% excess capacity for uncontrolled inflow rates.

^dCapacity assuming the Rabbit Lake mill can process 336 m³/h (maximum capacity of Eagle Point to mill pipeline) in 2010; with an increase to 446 m³/h in 2011.

In order to address this issue, installation of a reverse osmosis (RO) plant is suggested. Osmosis is the mechanism whereby two solutions of differing solute concentrations, separated by a membrane, attempt to equalize the concentrations by allowing solvent to pass through the membrane. A solution consists of a solvent (a liquid capable of dissolving solids) and a solute (the dissolved solids). The movement of the solvent across the membrane causes a release of energy in the form of “osmotic pressure”. By forcing energy back into the system through applying external pressure, this movement can be reversed. Instead of creating equilibrium

concentrations of solute, a larger difference in solute concentration is created. This is the process known as reverse osmosis (RO). Reverse osmosis works by forcing effluent through a selective membrane. The smaller components of the effluent (water molecules) are permitted to pass through the membrane. Larger components (dissolved undesired metal ions), which cannot pass through the membrane, are filtered out to create the concentrated reject stream of the reverse osmosis plant. This is pumped to the mill for further treatment.

The efficiency of reserve osmosis is controlled by metal concentration, effluent pressure, and effluent flow rates. Manipulating these parameters alters the ratio of the reject and water streams, allowing for a more flexible water management system.

Test work has shown that metal concentrations below the environmental limit can be achieved in the water passing through the membranes, resulting in an effluent stream that can be discharged directly to the environment. This, through pre-treatment of Eagle Point effluent, will reduce the volume of water sent to the conventional chemical treatment plant at the Rabbit Lake mill. An RO plant alone cannot completely replace a conventional chemical treatment plant, since an RO plant generates a concentrated waste stream that still requires conventional chemical treatment.

An important source of data and experience for RO technology is Cameco's Key Lake operation. Key Lake currently treats effluents on site using an RO facility. The use of this facility has helped form the decision to pursue RO technology at Rabbit Lake. As well, Melis Engineering Ltd. has provided consulting services for the proposed RO facility. It has compiled data from Rabbit Lake's water balances, historical databases, RO test work, and Key Lake's RO facility to provide a series of scenarios listing estimated metal loadings to the environment if an RO plant is constructed at Eagle Point. These scenarios indicate a noticeable reduction in metal loadings to Horseshoe Creek. It should be noted that although these reductions are not significant, they are an improvement over current loadings. This is important because reduced loadings are achieved even after water volumes requiring treatment are increased.

4.3 Value Chain Summary

As previously noted, an RO plant at the Eagle Point mine is crucial to further development of the mine. Without an RO plant the mine will have to shut down and Cameco Corporation will lose its strategic advantage in the uranium market due to loss of production. The RL mill will also have to go to care and custody for the next 5 years until the Cigar Lake mine is commissioned. This is unattractive, given the costs of both maintenance and start-up and the

challenges of assembling a qualified workforce from scratch in 2016. The RO plant has the potential to deliver some return on investment at low risk in the interim period, while improving environmental performance and maintaining local employment over the next 5 years.

5: Eagle Point Mine

Cameco's Eagle Point mine has been producing uranium since 1994. Although ore production was initially expected to last until 2002, additional reserves have since been discovered, extending the life of the mine. As the underground workings are developed, the rate of water inflow continues to increase.

5.1 Life-of-Mine Plan

The Eagle Point life-of-mine plan is described in this section. The life-of-mine plan is derived from the reserves and resources illustrated in Table 5-1 and Table 5-2: Resources as of March 2011 respectively. These figures were determined by the Mining Resources group in the Cameco corporate office.

Table 5-1: Reserves as of March 2011

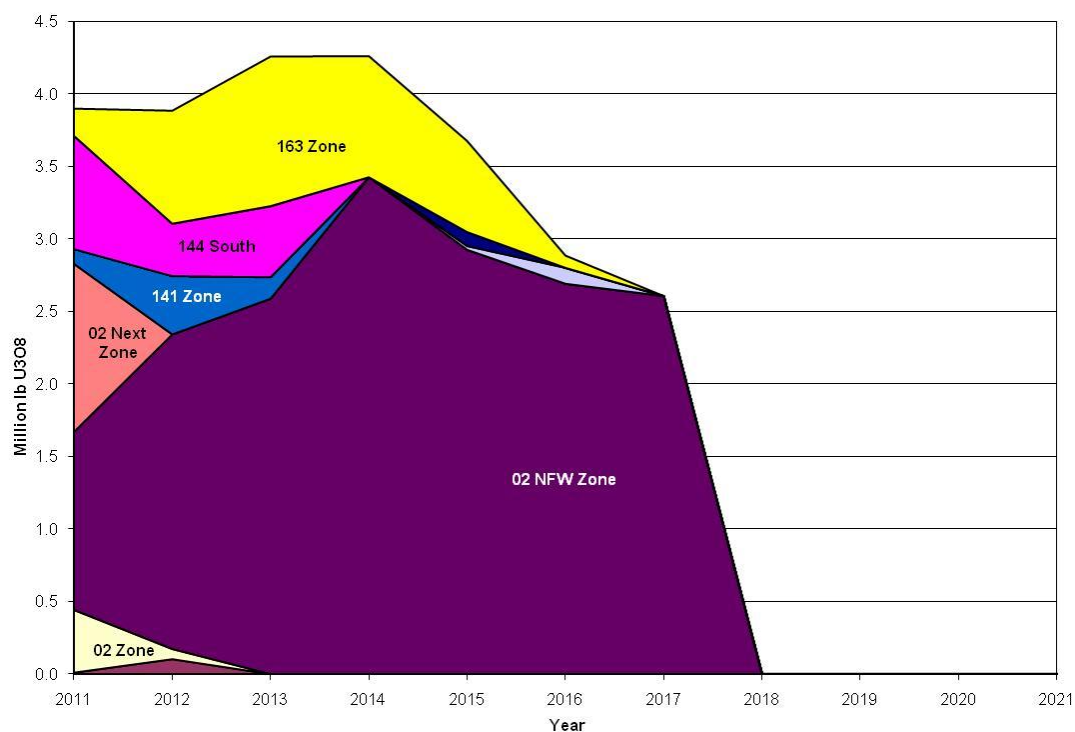
		Tonnes	%U₃O₈	Total U₃O₈ (lb)
PROVEN				
	Mine Stockpile	9,621	0.50	105,363
	Mill Stockpile	10,120	0.83	185,676
	O2	19,883	0.58	254,314
	TOTAL PROVEN	39,624	0.62	545,353
PROBABLE				
	O1	1,269	1.47	41,240
	Lower 144	6,000	0.83	110,000
	163	205,220	0.86	3,904,858
	O2NEXT	26,854	1.71	1,010,615
	O2NEXT FW	1,150,308	0.73	18,418,321
	Upper 144	88,403	0.78	1,523,262
	TOTAL			
	PROBABLE	1,478,054	0.77	25,008,296

Table 5-2: Resources as of March 2011

		Tonnes	%U₃O₈	Total U₃O₈ (lb)
INDICATED				
	O1	14,134	0.85	263,334
	O2	40,208	0.51	452,930
	O2NEXT FW	245,517	0.37	1,994,305
	Powell	25,500	1.94	1,093,000
	Upper 144	22,662	0.40	198,385
	TOTAL			
	INDICATED	348,021	0.52	4,001,954
INFERRED				
	RL Stockpiles	90,819	0.22	448,520
	O2NEXT	2,178	0.71	34,124
	Powell	253,900	1.67	9,347,000
	Sump Zone	22,548	0.83	414,127
	TOTAL			
	INFERRED	369,445	1.26	10,243,771

Figure 5-1 illustrates the target life of mine production schedule utilizing both reserves and resources. The schedule is subdivided into three components, proven and probable reserves and measured, indicated, and inferred resources with reasonable potential to be converted into proven or probable reserves in the next few years.

Figure 5-1: Graphical representation of Base Case - Life of Mine Production 2011



(Cameco Corporation, 2011)

There are currently three active production zones at Eagle Point:

- 02 North Extension Zone (02 NExt)
- 163 Zone
- 144 Zone

Mining is currently expected to continue until at least 2017. The latter two years (2016, 2017) are scheduled with a production rate that is below 3 million pounds per annum, primarily due to the single ore source available (02 NFW). This production rate is considered acceptable, as long as other production sources are available to feed the Rabbit Lake mill, namely Cigar Lake ore. The combined production rate from the two sources is sufficient to lower the mine's overall unit operating costs (including appropriate allocations from mill and overhead) such that a production rate less than 3 million pounds is feasible.

There is potential for this production rate to be supplemented at Eagle Point by 02 NFW and a new zone called the Powell Zone.

5.1.1 Reserves in the Mine Plan

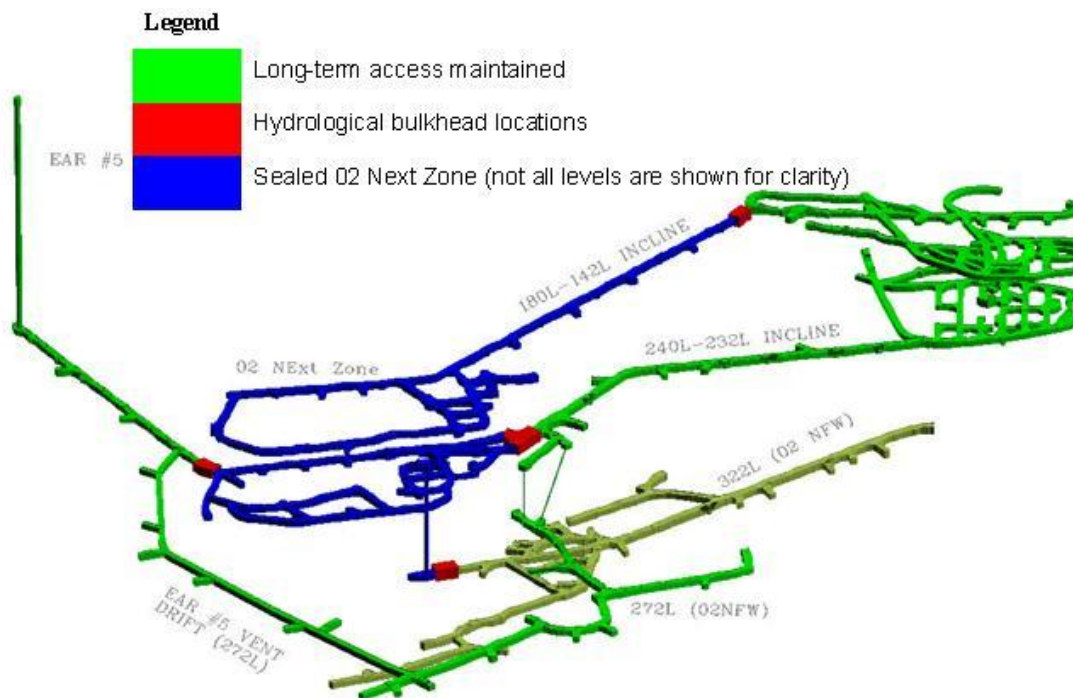
5.1.1.1 02 NExt Zone

This zone extends from the 292 Level (292L) to the 82 Level (82L). The level refers to the distance from the surface in metres. This zone has been in production since 2006 and is expected to be mined out in late 2011. The development of 82L will be complete by the end of Q1 2011. No other development is required for this zone.

An extensive grout cover program was implemented in this zone. This strategy was primarily selected because it reduced the burden on the dewatering system by eliminating the source water inflows. Currently, the majority of 82L has been developed. The water inflow rates per metre of development are lower than those of the other mine zones.

After mining this zone is completed, the plan is to permanently seal off the zone with hydrological bulkheads (Figure 5-2). This would reduce the amount of water entering the mine by 40–50 m³/h (~15% of the total mine water generated).

Figure 5-2: Proposed 02 NExt Hydrological Bulkhead Locations



5.1.1.2 163 Zone

The 163 Zone mineralization is readily accessible from sublevels established for earlier 144 Zone mining.

Mining of the 163 Zone is divided into four blocks, each separated by a sill pillar:

- Block 1 — 140 Level to 80 Level
- Block 2 — 215 Level to 155 Level
- Block 3 — 280 Level to 230 Level
- Block 4 — Below 280 Level

Block 1 is nearly mined out, and Blocks 2 and 3 have been mined out. Extraction of the sill pillar between 215L and 230L is currently in progress.

Preliminary diamond drilling results in Block 3 and Block 4 indicated the presence of groundwater associated with a “Quartz Vein”, which in actuality is better characterized as a silicified shear zone. All development in the area of this shear zone below 230L has been halted pending further assessment of the significance of this groundwater. Prior to development and production in Block 3, the zone was actively drained in a controlled manner.

5.1.1.3 02 North Footwall Zone

The 02 North Footwall Zone (02 NFW Zone) reserves are located approximately 120 m stratigraphically from the footwall of the 02 NExt Zone from 272L to 542L.

The zone is currently subdivided into three blocks:

- Block 1: 272 Level – 362 Level
- Block 3: 372 Level – 442 Level
- Block 4: 452 Level – 542 Level

Additional blocks may be added with depth as additional diamond drill information becomes available. Development for this zone is currently in progress. Over 11,500 m of development are required between 2011 and 2016. This zone represents greater than 50% of annual production from 2012 onwards.

5.1.1.4 144 Zone Reserves

The 144 Zone has been in production since 1993. Lower grade resources were recognized at the southern extremity of this zone (144 South) during previous mining but were not mined

because of low uranium prices. Since that time, the resources have been reclassified as reserves, and mining is currently in progress to extract the stopes between 180L and 80L.

Mining conditions have been somewhat challenging in this zone. The poor to fair ground conditions, the increasing proximity to the lake as mining develops, and the presence of water-bearing faults and structures have introduced a higher than average amount of water into the mine workings. Conditions are similar to 02 NExt; therefore a grouting strategy is being implemented to minimize the water inflow. In comparison to the previous level (100L) water management has improved as a result of the grouting.

5.1.2 Reserve Remnants

Remnants remaining in previously exploited zones will be mined prior to closure. Remnants were not mined previously for economic, access, or geotechnical reasons. A number of the remnants will be mined in 2011 and 2012 while production from the 02 NFW Zone is ramping up owing to lack of alternate sources of ore available at that time. If actual production from the primary mining zones is adequate to meet operation needs, remnant stopes may be deferred.

5.1.2.1 02 Zone Remnants

The remaining stopes in the 02 Zone are located between the 90 and 150 Levels. Up to five additional stopes will be mined, pending ore development to identify final stope boundaries. Development is required on 90L, 105L, 120L, and 150L.

A remnant stope, 180-490, also remains between the 180 and 150 Levels. This stope is included in the mine plan for 2016, but it is unlikely that this stope will be mined owing to technical and operational challenges (mainly water inflow) associated with it.

5.1.2.2 01 Zone Remnants

One remnant stope remains in the 01 Zone (120-350A). It is tentatively planned to be mined out in 2012. Further water inflow should be minimum as development is complete.

5.1.2.3 Sump Zone Remnant

One marginally economic stope (140-010) between the 140 and 125 Levels is scheduled to be mined in 2014. Minor development is required from existing excavations which will produce small water inflow.

5.1.2.4 Lower 144 Zone Remnants

Two remnant stopes are planned for mining in 2015 and 2016 (385-050 and 370-050). Minor development is required from existing excavations.

5.1.3 Resources and Unclassified Mineralization in the Mine Plan

For planning purposes, it is necessary to assume that certain resources, and even unclassified mineralization, will be upgraded to reserves during the life of mine plan. In the case of Eagle Point, the incorporation of resources into the mine plan is essential to ensure that an economic site production rate can be maintained; this is due to the high fixed cost nature of remote northern operations.

5.1.3.1 141 Zone

The ore contained within the 141 Zone is currently unclassified, but it is included in the mine plan. Initial development preparations have been initiated on 171L and 181L. The stopes initially planned from 181L and 171L have been removed from the mine plan because of additional diamond drill results obtained in 2010. Development in these headings has stopped.

The ore in the upper sections of the 141 Zone (101L to 151L) appear to be viable and is scheduled for removal in 2011–2013.

5.1.4 Measured, Indicated, and Inferred Resources Not in the Mine Plan

5.1.4.1 02 NFW

02 NFW ore that has been classified as a resource has been excluded from the mine plan. Approximately 1.5 million pounds appear in the life of mine schedule in 2018 and 2019; however, the production rate is not considered sufficient to continue mining operations. This ore will likely be mined; however, it will require optimization of the current schedule or another production source to supplement the production rate from EP.

5.1.4.2 Powell Zone Indicated and Inferred Resources

This new zone was included in inferred and indicated resources for the first time as of December 31, 2010, based on surface drilling results. There is currently an inadequate amount of technical and economic data to include it in the long-term base case mine plan.

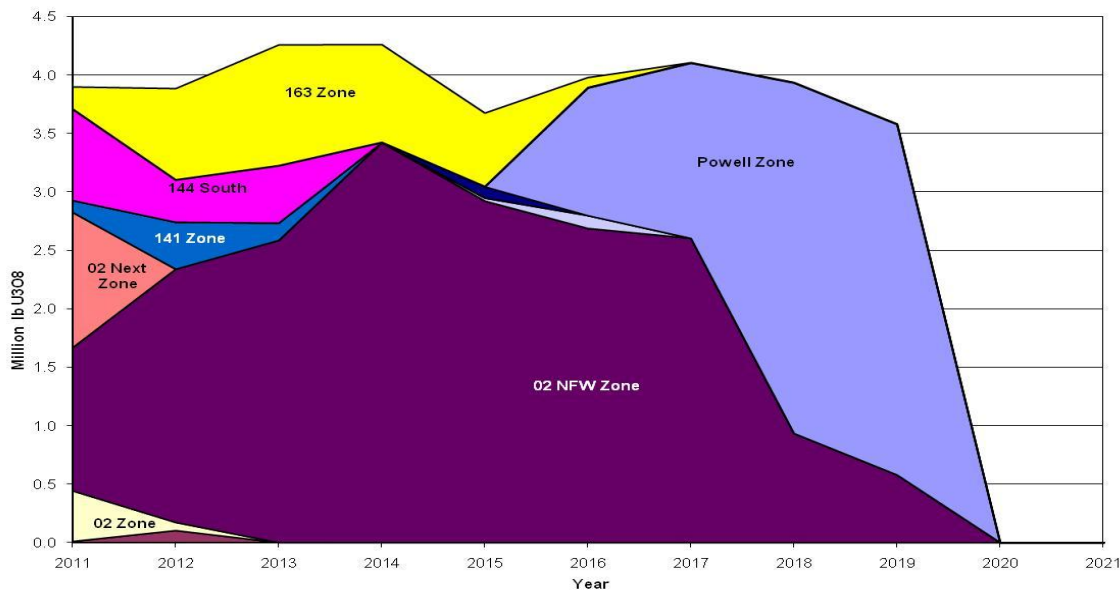
Development for two exploration drifts from the 272L and the 382L of the footwall zone have been included in the mine plan. None of the resources from the zone have been included in this mine plan. Pre-feasibility study work will be conducted in 2011 to enhance the mine plan and water inflow estimation for this zone

5.2 Eagle Point Growth Potential

The Eagle Point mine plan, as discussed above, does not include resources from Powell Zone or 02 NFW.

Figure 5-3 below presents a reasonable growth scenario for the mine plan; it includes the identified resources. Production is extended to 2019 at a nominal rate of 3.8 million pounds per annum, exclusively from known Eagle Point sources. Potential ore sources from 02 NFW below 542L, or unidentified from Powell Zone, have not been included because of the lack of diamond drilling information.

Figure 5-3: 2011 Growth Life of Mine Plan



(Cameco Corporation, 2011)

5.3 Eagle Point Exploration Potential

In the next few years, both underground and surface exploration drilling will continue to find more ore reserves. Approximately 25,000 m of underground exploration drilling are planned for 2011. Drilling will focus on the 02 NFW zone below 542L, and northwards towards the “gap” between 02 NFW and the Powell Zone. Mine Development Estimation

Order of magnitude lateral development requirements are estimated in Table 5-3. Growth opportunities include further development of 02 NFW below 542L and development of Powell Zone into a productive zone. The growth projection is a very rough estimate.

Table 5-3: Development Estimation

Year	Life-of-Mine Plan (m)	Life-of-Mine + Growth Opportunities (m)
2010	4450	4450
2011	4980	4800
2012	3880	4800
2013	3000	4500
2014	3000	4800
2015	3000	4300
2016	1500	2000
2017	500	1500
2018	500	1500

(Cameco Corporation, 2011)

5.4 Mine Development Estimation

Order of magnitude lateral development requirements are estimated in Table 5-3. Growth opportunities include further development of 02 NFW below 542L and development of Powell Zone into a productive zone. The growth projection is a very rough estimate.

5.5 Dewatering Requirements

Mining the Eagle Point mine will continue for the next few years as presented here. This is contingent upon establishing satisfactory groundwater handling, drainage, or control plans for the different zone resources at depth.

Significant advantages can be obtained from permanently sealing water bearing zones of the mine. It is planned to install hydrological bulkheads to isolate the 02 Next Zone in 2012, which could reduce mine water by up to 90 m³/h.

Current investigations indicate that an RO water treatment facility will be required at Eagle Point, in spite of successful efforts to reduce water generated by the mine. An RO plant at Eagle Point will assist the Rabbit Lake operation in optimizing its environmental performance as well.

6: Detailed Project Description

A detailed project description of the installation of an RO plant at Eagle Point and an analysis of the effect of the new plant on existing site infrastructure follows.

6.1 Project Overview

Since the initial discovery and mining of the Eagle Point deposit, additional resources have been identified, continually expanding the underground mine. This has caused increased inflow water that must be treated on site, as it has been contaminated with metals leached from the ore bodies. Because of this increase in inflow water, the capacity of the conventional chemical effluent treatment circuits at Rabbit Lake mill to treat this effluent is nearing its maximum. Additionally, the expanding underground workings will produce significantly more tailings than was originally expected. These tailings must be kept in the Rabbit Lake In-Pit Tailings Management Facility (RLIPTMF). Effluent produced by water seeping from the tailings must be treated as well. This is known as raise water, and it represents a large percentage of effluent requiring treatment. As long as Eagle Point is producing ore, this raise water must be treated, which further limits the volume of effluent from Eagle Point that can be treated.

In order to manage the increased water flows, Cameco is currently investigating options for treating effluent that will either increase the treatment circuit capacity or reduce the volume of effluent requiring treatment. One method for reducing this volume is the implementation of reverse osmosis (RO) membrane technology to treat water being pumped from Eagle Point underground. An RO plant will provide the ability to reduce routine water flows to the mill effluent treatment circuits, which will in turn improve the capability of dealing with unforeseen or non-routine flows. This RO plant is expected to produce two streams of effluent: a reject stream containing concentrated dissolved metals and a clean stream that will be discharged directly to the environment. This clean stream represents the reduction in effluent volume that requires treating.

In 2006, a report was submitted which included an evaluation of reverse osmosis technology. This evaluation demonstrated the abilities of an RO plant to reduce net effluent flows to the mill effluent treatment circuits. A pre-feasibility study is currently being conducted to further investigate the benefits of installing an RO plant.

This plant will not replace any equipment or circuit currently in use but will be operated to further enhance the treatment of effluent over current operation. It is the aim of the RO plant to achieve the following benefits:

- increase Eagle Point inflow water pumping capacity; this improvement is needed because of continued development of the underground workings
- improve the ability of the Rabbit Lake effluent treatment system to handle additional non-routine flows that may be experienced underground
- improve the flexibility of the Rabbit Lake effluent treatment system by providing the ability to alter the ratio of reject and clean streams
- decrease the volume of effluent pumped to the Rabbit Lake mill for treatment

The current overview of the water flows between Eagle Point and the final effluent discharge can be seen in Figure 6-1. This figure also shows the proposed RO plant within the context of the effluent flows. The addition of this RO plant will require the following:

- site preparation to support the construction of the RO plant
- construction of the RO plant
- construction of the surge pond and piping that will feed the RO plant
- installation of piping to connect current pipelines to the proposed RO plant
- creation of a new discharge point into Collins Bay for the clean stream produced by the RO plant

The diagram illustrates the water management system for the Eagle Point Mine, showing the flow of water from the mine through various ponds and treatment facilities to Hidden Bay. The system includes the following components and flow paths:

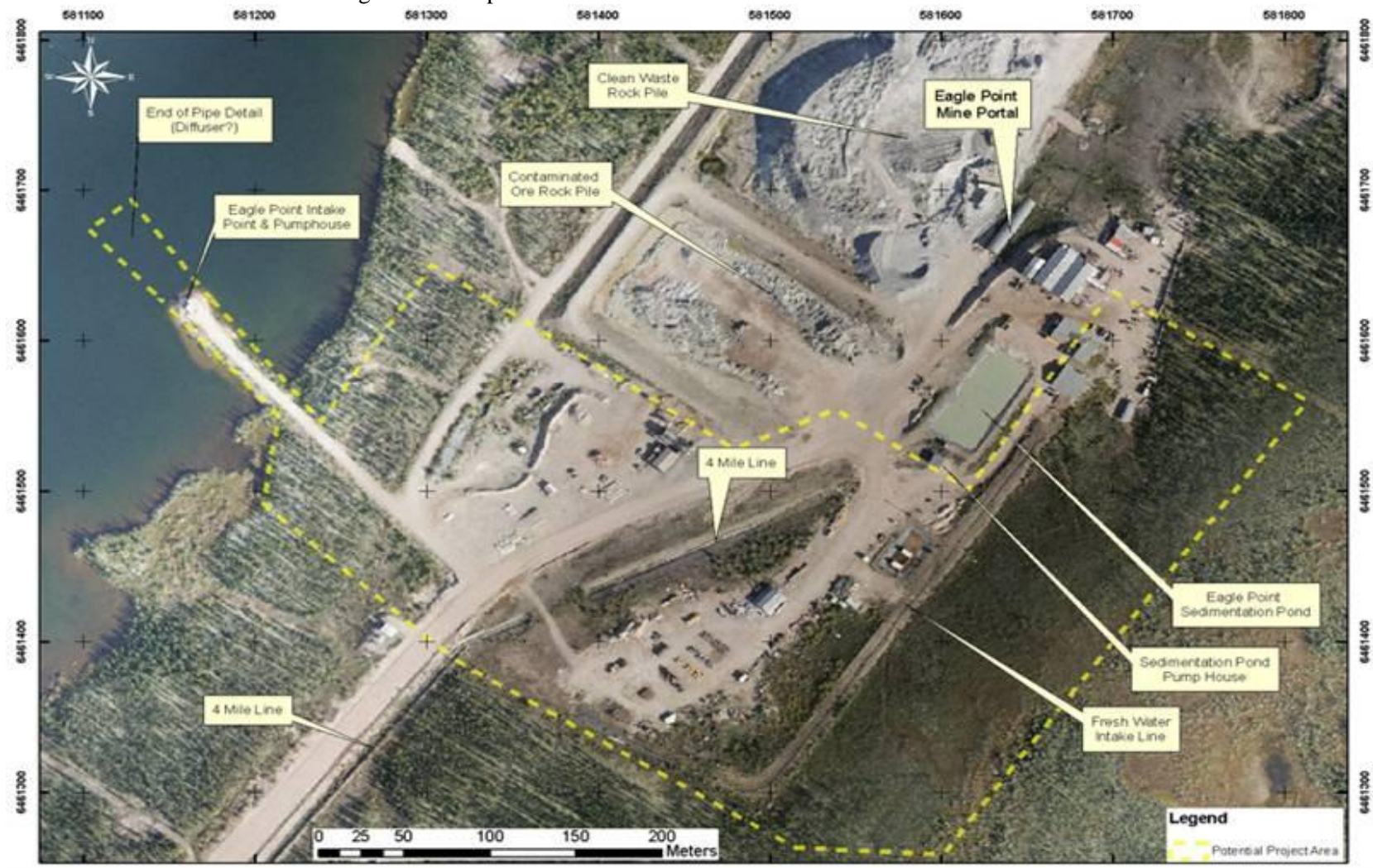
- Eagle Point Mine** (Existing) discharges water (~200 m³/hr variable) to the **Eagle Point Sed Pond** (Existing) via an **Underground** line.
- Eagle Point Sed Pond** (Existing) has an **Existing max capacity ~320 m³/hr** and is connected to the **B Zone Sed Pond** (Existing) via a **4 mile line**.
- B Zone Sed Pond** (Existing) is connected to the **Mine Surge Pond** (Existing) via a **6 mile line**.
- Mine Surge Pond** (Existing) feeds into the **Mill Neutralization Circuit** (Existing).
- Mill Neutralization Circuit** (Existing) feeds into the **Effluent Treatment** (Existing).
- Effluent Treatment** (Existing) discharges water (Average 2009 Discharge Rate ~510 m³/hr) into **Hidden Bay** via **Horseshoe creek**.
- Water Intake Line** (New) brings water from **Collins Bay** to the **Eagle Point Water Intake** (New).
- Eagle Point Water Intake** (New) feeds into the **RO Sedimentation Feed Surge Pond** (New).
- RO Sedimentation Feed Surge Pond** (New) feeds into the **RO Plant** (New).
- RO Plant** (New) produces **~200 m³/hr Reusable Treated Water** which is sent back to the **Eagle Point Water Intake** (New).
- RO Plant** (New) also produces **Backwash and Concentrate ~50 m³/hr** which is sent to the **Eagle Point Sed Pond** (Existing).
- Collins creek fresh water** (New) feeds into the **Mill Neutralization Circuit** (Existing).
- A, B and D Zones Seasonably variable** (New) feeds into the **B Zone Sed Pond** (Existing).
- Rabbit Lake in Pit Tailings Management Facility** (New) feeds into the **Mill Neutralization Circuit** (Existing).
- Above Ground Tailing Management Facility** (New) feeds into the **Effluent Treatment** (Existing).

Legend:

- Existing: Black outline box
- New: Green outline box with a green arrow pointing down

The proposed physical location of the RO plant can be seen in Figure 6-2. A space of approximately 14 ha is available at Eagle Point for construction of the plant. Cameco will work to utilize 9 ha of this space for construction, as about 5 ha has not yet been disturbed or cleared. Areas already cleared will require site preparation before construction of the RO plant can begin.

Figure 6-2: Proposed Location of the RO Plant and related infrastructure



(Cameco Corporation, 2011)

The actual location of the RO plant, surge pond, and additional infrastructure has not been finalized. Estimated dimensions for these major components are as follows:

- RO surge pond will be approximately 6125 m²
- RO plant will be approximately 1300 m²
- approximately 300 to 900 m of new pipelines

Also, the possibility of using underground storage capacity to feed the RO plant is being considered.

The surge pond will be constructed in such a shape that previously disturbed ground will be best used. The RO plant is expected to be skid mounted and should also use previously disturbed ground. The new piping to and from the plant will be installed alongside existing pipes wherever possible to make use of current pipe corridors.

6.2 Cameco Safety, Health, Environment, and Quality Management System

Cameco's integrated safety, health, environment, and quality (SHEQ) policy is the foundation of both the corporate and site management systems and links corporate and site objectives. With the consideration of applicable regulatory and statutory requirements, including the Nuclear Safety and Control Act (NSCA) and associated regulations, industry standards, and best practices, the Cameco SHEQ management system has been developed with the following principles:

- maintaining Cameco's current practice of keeping exposures to hazards such as radiation as low as reasonably achievable
- complying with and exceeding legal requirements
- ensuring quality of processes, products, and services
- preventing pollution
- continually improving overall performance

The SHEQ management system is defined and managed through the following corporate and site core programs:

- Safety and Health Management Program
- Environmental Management Program
- Quality Management Program

- Emergency Preparedness and Response Program
- Radiation Protection Program
- Contractor Management Program

These programs are currently in place at Rabbit Lake and, as such, are applicable to the installation and operation of an RO plant.

6.3 Project Components

6.3.1 Underground Mine Water

The underground workings at Eagle Point produced 260–264 m³/h of water during 2009. Mine water volumes associated with annual mine development have been calculated up to 2018. From 2010 until permanent upgrades can be installed, temporary underground storage will be used. Pipeline upgrades, planned for completion within 2011, will increase pumping capacity from 336–446 m³/h. Along with this upgrade, Cameco is investigating the following options for reducing inflow to the underground workings:

- grouting off select areas of the mine
- continuing to search for un-grouted surface holes and sealing them
- accelerating the schedule for mining the 02 Next zone so it can be sealed
- using relatively clean underground water for activities such as washing down muck piles and drift faces

The effects of these control solutions are not certain, justifying the need for a more permanent solution, such as the proposed RO plant.

6.3.1.1 Surface Water

Sources of surface water on site include shallow groundwater, melt water runoff, and precipitation. Surface water may not count for a significant portion of feed to the RO plant. However, because this surface water is treated at the mill, this is additional volume that must be accounted for in the water balance. Spring melt water, in particular, creates spikes in water volume. The installation of an RO plant will create contingency capacity to deal with potentially higher than expected melt water volumes.

6.3.2 Water Treatment Facilities

6.3.2.1 Existing Water Treatment Facilities

The current operating water treatment system is located at the Rabbit Lake mill, with additional treatment available at the effluent polishing area. A series of three weirs at the effluent polishing area allow for additional time for solids to settle. Weir #3 is the final effluent discharge point, introducing treated effluent to Horseshoe Creek. The water treatment system is designed to handle a maximum flow of 720 m³/h (12 000 L/min). There is additional storage capacity available underground and in the RLIPMTF for upset conditions. Upset conditions occur when the performance of effluent treatment is compromised. Effluent is pumped to the RLIPMTF until circuit conditions stabilize. The limiting factor in the existing water facilities is the pipeline connecting Eagle Point and the Rabbit Lake mill. This pipeline has a maximum capacity of 336 m³/h. This RO project does not include upgrades to the treatment circuits at the mill.

The mill at Rabbit Lake treats water from the following sources:

- water pumped from B-zone
- the Rabbit Lake in-pit tailings management facility (RLITMF) (known as raise water)
- Rabbit Lake above ground tailings management facility (AGMTF)
- Eagle Point underground inflow water
- drainage from Eagle Point, B-zone, and mill ore surface storage pads and waste rock piles
- mill process water
- surface runoff water from contained structures
- camp grey water and sewage
- water from various surface pumps

Previously, water was pumped from the D-zone pit; however, this source was decommissioned in the summer of 2010.

6.3.2.2 Changes Required to Water Treatment Facilities

The installation of a new RO plant will require new water handling and discharge infrastructure capable of handling underground water inflow rates. The proposed design will be a skid-mounted modular plant with a feed capacity of 250 m³/h. The modular design of the RO plant will improve flexibility and allow for future expansion. This will be particularly helpful if unanticipated inflows are experienced underground.

6.3.3 Water Discharge

6.3.3.1 Existing Water Treatment and Discharge

Water treatment is performed primarily at the Rabbit Lake mill. Water from the Eagle Point sedimentation pond and the RLPTMF raise pumps is sent to the mill. After treatment, the effluent is pumped to the effluent polishing for additional radium removal and solids settling. The final treated effluent is discharged at Weir #3 into Horseshoe Creek/Hidden Bay.

6.3.3.2 Changes Required to Water Treatment and Discharge

New piping is required to bring water from the Eagle Point sedimentation pond feed pipe to the RO surge pond. Water will be pumped from the RO surge pond to a series of sand filters to remove solids that could potentially plug the RO membranes. The operation of the RO plant will be a continuous process versus a batch process, so continual monitoring of water quality will be required. The RO plant will produce two streams: the treated water (permeate) and the concentrated reject (waste).

The permeate will be directed back to the Eagle Point Collins Bay intake pump house and, depending on whether the permeate will be used underground or not, sent back underground or discharged to Collins Bay. This decision will be based on water requirements underground. The reject stream will be directed back to the Eagle Point sedimentation pond for treatment at the Rabbit Lake mill.

6.3.3.3 Pipeline Routing

Location of new pipelines will be based on the shortest distance possible on previously cleared and disturbed ground. These pipelines will make use of existing pipeline corridors.

Upgrades to underground mine water handling will not be required for this project. Future upgrades may be necessary to handle increased mine water inflow rates; however, this is outside the scope of the RO plant project.

Directing the permeate produced by the RO plant to the existing Eagle Point Collins Bay water intake pump house will require approximately 300 m of new pipeline. This pipeline will make use of the current freshwater intake line corridor.

New piping will be required to take the concentrated RO plant reject back to the Eagle Point sedimentation pond. This pipeline will connect the plant and pond by the shortest path possible.

6.3.3.4 Discharge Point

The discharge point for the RO plant permeate will be located at the existing freshwater intake in Collins Bay.

6.3.3.5 Discharge Rate

The RO plant is expected to produce approximately 200 m³/h of permeate and 50 m³/h of concentrated reject. There is potential for future expansion and increased flow rates if a modular design is installed. It may be possible to achieve a discharge rate of more than 1000 m³/h if the current design is doubled. This final discharge rate will depend on the final plant design, actual performance of the plant, and regulations for allowable metal loading to Collins Bay.

6.3.4 Electrical Power Requirements

The RO plant is estimated to consume 1 kW for every 1 m³/h of effluent treated. Operating the plant at full capacity will require up to 450 kW. The sub-station located at Eagle Point currently has a capacity of 1 MW. This is adequate power to operate the RO plant.

6.3.5 Ground Preparation

Ground preparation will include excavation and levelling of earth for the RO surge pond. Rearrangement of the current lay down and storages areas at Eagle Point may be required to make room for the RO plant. As mentioned earlier, reasonable efforts will be made to use previously disturbed ground.

6.3.6 Waste Management

Construction of the RO plant will create the following sources of waste:

- industrial waste (e.g., off-cuts and over-supplied items)
- hazardous substances (e.g., chemicals such as paint and solvents)
- contaminated waste (e.g., waste materials that have come in contact with chemicals or radioactive material)

- domestic waste (e.g., garbage)

6.4 Decommissioning and Reclamation

A specific reclamation plan for the RO plant has not been put in place as it is expected that the existing infrastructure and financial assurances should be sufficient to cover the RO plant to the end of the economic life of Rabbit Lake.

6.5 Project Schedule

Cameco is pursuing an aggressive timeline for this RO plant owing to the requirement for additional water management capacity at Eagle Point by the end of 2012.

7: Existing Environment

Owing to the length of time the Rabbit Lake operation has been in operation, a significant amount of data has been collected. This data has helped create a detailed understanding of the environment in which Rabbit Lake operates.

7.1 Terrestrial Environment

The new RO plant and all related infrastructure will be located within the existing Rabbit Lake surface lease.

7.1.1 Wildlife

Native wildlife within the vicinity of the Rabbit Lake operation includes lynx, black bear, wolf, beaver, ermine, moose, otter, marten, muskrat, and snowshoe hare. Various species of caribou have been seen in the area, but this is rare and occurs occasionally during migration.

7.2 Aquatic Environment

7.2.1 Aquatic Species

Collins Bay supports a wide range of aquatic species. Most common of these species are northern pike, walleye, lake trout, white sucker, longnose sucker, and lake whitefish. The shores of Collins Bay and waters of Collins Creek represent important spawning areas for these fish.

7.3 Resource Use

7.3.1 Traditional and Non-traditional Land Use

Harvesting the waters in and the lands surrounding Wollaston Lake provides seasonal income and income-in-kind for a number of local residents, particularly the resident aboriginal population. These sources of income are present in the form of sport fishing, hunting, trapping, and guiding. Seasonal tourism in Northern Saskatchewan is a way a of life for many of these residents, with the season extending from mid-May through August.

7.3.2 Socio-economic Environment

Rabbit Lake is committed to providing financial resources to the Residents of Saskatchewan's North (RSN) by providing employment and contract opportunities for residents and companies capable of providing services to the operation. These commitments are mandated in the Surface Lease Agreement between Cameco and the Government of Saskatchewan (2004).

The RO plant will generate a continuation of jobs and other related opportunities over the next four years. Without the RO plant, the Eagle Point mine must shut down, and numerous jobs will be lost. For employees, it is obvious that continuous employment is highly desirable.

8: Potential Effects

Regulators and government bodies are responsible for approving the installation of the new RO facility based on studies that identify the impacts the new facility will have on people and the environment. They must be particularly careful when approving changes to a mining operation as these sites have the potential to seriously harm the environment. This section discusses the possible positive and negative interactions between the site and the surrounding environment. Also discussed are the adverse effects experienced in the case of accidents or system malfunctions.

8.1 Spatial and Temporal Boundaries

For effective identification of potential effects, it is important to establish spatial boundaries surrounding the activities associated with constructing and operating an RO facility. Previous studies have established such boundaries, and so similar definitions will be used here.

- site study area (SSA): the area directly affected by the activities associated with the RO plant and within the current provincial lease boundary
- local study area (LSA): the area outside the site study area where there is a reasonable potential for effects due to operation of the RO plant. This area includes (a) land contained within the current provincial lease boundary, (b) Collins Bay, (c) Horseshoe Creek, and (d) portions of Wollaston Lake in close proximity to the mine property
- regional study area (RSA): the area known as the Athabasca Basin and all communities located within the Basin. Any mining operations that may have a cumulative effect on the environment are included in this area.

Temporal boundaries and timeframes for activities are as discussed in Section 2.

8.2 Potential Project–Environment Interactions

In order for the project to affect the surrounding environment, there needs to be a source, a connection, and a receptor. In this case, the source is the installation, operation, and decommissioning of the proposed RO plant. The connection includes any pathway between the

source and receptor. The receptor includes the entity receiving what is produced by the source. Potential project–environment interactions for the different environments affected are outlined in Table 8-1: Potential Effects to Biophysical Environments and Table 8-2: Potential Effects to Human Health and Economic and Resource Environments.

Table 8-1: Potential Effects to Biophysical Environments

Project Phase	Project Activity	Sensory	Atmospheric Environment	Aquatic Environment					Terrestrial Environment			
		Auditory, Visual, and/or Olfactory	Air Quality	Water Quality	Lake Levels and stream flows	Sediment Quality	Shoreline	Aquatic Habitat and Health	Groundwater	Soils and Terrain	Vegetation	Wildlife and Wildlife Habitat
Construction	Excavation of an RO pond on surface (terrestrial disturbance)	○	○	○					○	○	○	○
	Installation of an RO water treatment facility (terrestrial disturbance)	○	○	○					○	○	○	○
	Installation of routine and non-routine treated water discharge pipeline to Collins Bay (terrestrial/aquatic disturbance)	○	○	○		○		○	○	○	○	○
	Accidents and malfunctions (e.g., petroleum product spills)			○		○		○	○	○	○	○
Operation	Discharge of routine and non-routine treated water to Collins Bay (aquatic disturbance)	○	○	○	○	○		○				
	Accidents and malfunctions (e.g., petroleum product spills)			○		○		○	○	○	○	○
Decommissioning	Removal of routine and non-routine treated water discharge pipeline to Collins Bay (terrestrial/aquatic disturbance)	○	○	○		○		○	○	○	○	○
	Removal of RO pond and RO water treatment facility (terrestrial disturbance)	○	○						○	○	○	○
	Accidents and malfunctions (e.g., petroleum product spills)			○		○		○	○	○	○	○

(Cameco Corporation, 2010)

Table 8-2: Potential Effects to Human Health and Economic and Resource Environments

Project Phase	Project Activity	Human Health					Economy		Land and Resource Use				
		Radiation Doses to the General Public	Radiation Doses to Workers	Non-radioactive Contaminant Exposure to the General Public	Non-radioactive Contaminant Exposure to Workers	Occupational Hazards	Employment	Business	Traditional and Domestic use by Aboriginal People	Commercial and/or Recreational Hunting, Trapping, and Fishing	Tourism, Outfitting, and Lodges	Forestry, Mining, and Other Resource Extraction	Physical and Heritage Resources
Construction	Excavation of an RO pond on surface (terrestrial disturbance)			○	○	○	○	○	○	○		○	○
	Installation of an RO water treatment facility (terrestrial disturbance)			○	○	○	○	○	○	○		○	
	Installation of routine and non-routine treated water discharge pipeline to Collins Bay (terrestrial/aquatic disturbance)			○	○	○	○	○	○	○		○	○
	Accidents and malfunctions (e.g., petroleum product spills)				○	○			○	○		○	○
Operation	Discharge of routine and non-routine treated water to Collins Bay (aquatic disturbance)	○	○	○	○	○		○	○	○	○	○	
	Accidents and malfunctions (e.g., petroleum product spills)	○	○	○	○	○			○	○	○	○	○
Decommissioning	Removal of routine and non-routine treated water discharge pipeline to Collins Bay (terrestrial/aquatic disturbance)			○	○	○	○	○	○	○		○	
	Removal of RO pond and RO water treatment facility (terrestrial disturbance)			○	○	○	○	○	○	○		○	
	Accidents and malfunctions (e.g., petroleum product spills)				○	○			○	○		○	

(Cameco Corporation, 2010)

8.2.1 Biophysical Environment

With respect to current operations at Rabbit Lake, the following biophysical components may see effects due to the project.

- sensory: potential effects due to noise, vision and smell from activities (e.g., noise from equipment)
- atmosphere: potential atmospheric effects due to inert dust dispersion during construction, CO₂ exhaust from equipment, and potential radon emission increases
- aquatic: potential aquatic effects due to construction of new discharge point into Collins Bay, permeate discharge during RO plant operation, and effluent discharge to Horseshoe Creek
- terrestrial: potential terrestrial effects, including to groundwater, due to land clearing, excavation, erosion, and potential spills during construction, and pipeline and pond liner leaks during operation
- receptors (ecological and human): potential human and ecological receptor effects from interactions with the above environmental components affected by the RO plant. Human receptors may include Cameco employees, contractors, and the general public.

8.2.2 Human Health and the Socio-Economic Environment

Wollaston Lake provides many opportunities for use as both traditional Aboriginal land and commercial land in the form of tourism and outdoor recreation. The RO plant may cause the following effects to these environments:

- economic: potential for employment and business through construction and building supply requirements
- land and resource use: potential to affect recreational tourism and outfitting activities, traditional land use, local aboriginal and non-aboriginal heritage resources, and traditional land resource use.

8.3 Environmental Pathway Interactions, Mitigations, and Determination of Potential Effects

This section provides a relatively basic evaluation of effects of certain environmental pathways. This evaluation is based on professional interpretation and judgement. If a new environmental assessment and environmental impact study (EIS) is required for project approval, these effects will be studied in further detail. An EIS would include public consultation and has the potential to introduce additional issues that may have been overlooked. In the case of any spills on or around the new infrastructure, the existing emergency preparedness and response program (EPRP) will be applied.

8.3.1 Sensory

Construction, operation, and decommissioning of the RO plant is more than likely going to generate visual and noise levels above existing ambient levels. Mitigation for visual effects (e.g., welding) may include prefabrication of equipment under conditions that control visual effects (e.g., welding bay). Personnel around the areas will be provided with a means to decrease visual effects (e.g., welding masks, tinted safety glasses). Noise effects (e.g., grinding, heavy equipment, steel cutting) may also be controlled by preparing certain infrastructure in a controlled environment, providing noise protection to personnel, and ensuring heavy equipment has mufflers properly installed.

8.3.2 Atmospheric Environment

8.3.2.1 Air Quality

Air emissions associated with the RO plant will be present mainly during construction and decommissioning. The main sources of air quality contaminants are dust from the ground and diesel emissions from heavy equipment. Mitigating these sources will require dust suppressants for the surrounding ground and the use of equipment that meets federal emission standards.

8.3.3 Aquatic Environment

8.3.3.1 Water Quality

The purpose of the RO plant project is to supplement the effluent treatment circuits at the Rabbit Lake mill. It is evident that any changes to these effluent treatment circuits will affect the water environment, either positively or negatively. It is the project aim to improve upon current

performance and environmental impact; however, there is potential during all three stages (construction, operation, decommissioning) to see occasional negative impacts.

The major concern surrounding water quality is the possibility of a leak or spill. This may include petroleum products, chemicals, and effluents entering or exiting the RO plant. The potential for chemical spills is most prevalent during construction and decommissioning when heavy equipment is in use. The potential for effluent leaks is most prevalent during operation of the plant when the surge pond and pipelines will be in use (such leaks could be caused by a burst pipeline or a pond liner breach).

Emergency procedures currently in place to deal with any leaks or spills on site will be sufficient to deal with any future spills or leaks associated with the RO plant. Spill response equipment will be readily available, and existing spill containment practices will be implemented.

8.3.3.2 Lake Levels and Stream Flows

Activities associated with the RO plant are not expected to affect water levels in any major bodies of water surrounding the Rabbit Lake property. The volume of water pumped up from the Eagle Point underground mine will increase according to the scheduled development and production activities. The change in water volume comes from introducing a new discharge point directly to Collins Bay as opposed to sending all water to Horseshoe Creek. Regardless of RO plant operation, all volumes of water will eventually end up in Wollaston Lake.

8.3.3.3 Sediment Quality

The purpose of the RO plant is to reduce the metal loadings to the environment that are currently experienced. However, because of the proposed new effluent discharge point at Collins Bay resulting from permeate flows, sediment quality may be affected. These loadings may affect this area locally, but the overall metal loading is expected to decrease as the volume of effluent discharged from the Rabbit Lake effluent treatment circuits is reduced. Potential receptors of these new metal loadings at Collins Bay include valued ecosystem components (VEC). The general public and workers in the vicinity may be affected indirectly. Non-routine effluent discharge as a result of accidents and malfunctions may also affect sediment quality.

8.3.3.4 Shoreline

The new discharge point at Collins Bay for RO plant permeate will utilize the existing Eagle Point intake berm. No modifications or effects to the physical shoreline are anticipated during construction, operation, and decommissioning of the RO plant.

8.3.3.5 Aquatic Habitat and Health

Construction, operation, and decommissioning of the RO plant all have the potential to affect the aquatic habitat and health in Collins Bay. Construction around the permeate discharge point may cause erosion and runoff. Although this discharge point is not located in known spawning locations, construction around this point will be completed outside of the known spawning time periods, as a mitigation practice to minimize environment impacts. In addition to this, appropriate erosion control structures will be put in place to further reduce the risk of negative effects.

To reduce impacts during operation of the RO plant, best practices will be put in place to ensure permeate discharged to Collins Bay meets regulatory requirements. The permeate will still contain some amount of contaminants, meaning the aquatic habitat and health near the discharge point will potentially be affected. It is anticipated that aquatic life near the Weir #3 discharge point will be less affected.

Aquatic biota near the RO plant and Collins Bay discharge point may see effects from spills during the life of the RO plant; however, existing mitigation techniques used at Rabbit Lake will be applicable to such incidents.

8.3.4 Terrestrial Environment

8.3.4.1 Groundwater

During construction, operation, and decommissioning, there is potential for the groundwater in the RO plant vicinity to be affected. The water table in this area is relatively shallow, which means mean that in the event of a spill or leak groundwater could carry the effluent to Collins Bay. Mitigation techniques will include implementing appropriate spill containment practices and following the EPRP. To prevent contamination from the surge pond during operation, the pond will be double-lined with impervious membranes and have leak monitoring systems in place.

8.3.4.2 Soils and Terrain

The effects to soil during the life of the RO plant may include

- soil profile disturbance
- soil contamination from spills
- erosion to exposed soil

The soil profile of the RO project footprint, including the RO plant location, surge pond, pipeline corridors, and new roadways, will be disturbed during construction and decommissioning. This disturbance will be minimized by the use of previously disturbed ground. As part of the decommissioning procedure, disturbed areas will be restored through the reclamation process.

Soil contamination is not anticipated; however, it is a possibility if spills occur. Spills involving petroleum products or chemicals will most likely occur during construction and decommissioning. Effluent spills may occur during operation. Current spill containment procedures will be implemented.

Soil erosion is expected to occur to some extent during construction and decommissioning, particularly during site preparation and road construction. The effects of soil erosion should lessen significantly once vegetation has the opportunity to establish itself. Areas such as road ditches may also experience erosion. This will be reduced by installing sediment control barriers and re-vegetating.

8.3.4.3 Vegetation

Any potential effects to vegetation will most likely be seen during construction of the RO plant and any related infrastructure. The majority of these effects will occur during site preparation for the plant and surge pond. Minor vegetation clearing may be required for installing new pipeline. Reasonable efforts will be made to keep infrastructure on previously disturbed ground; however, in the event that undisturbed areas are required a detailed investigation will be conducted to identify any rare vegetation. In addition, a forest product permit from the Saskatchewan Ministry of Environment (SMOE) will be obtained.

During operation, there is the potential for spills to affect vegetation. The EPRP currently in place will be applicable to these situations.

8.3.4.4 Wildlife and Wildlife Habitat

The Eagle Point area does not currently support a significant amount of wildlife; however, there is potential for wildlife to pass through or inhabit the area. Construction and decommissioning may affect wildlife and wildlife habitats. Accidents or malfunctions during operation may also have an effect. Using previously disturbed ground will minimize the effects on terrestrial wildlife habitat.

8.3.5 Occupational Hazards

All aspects of construction, operation, and decommissioning have potential to affect personnel working in and around the area. Hazards to personnel include but are not limited to heavy equipment operation, fumes (e.g., chemical, exhaust), poor ergonomics, radiation exposure, chemical contact, and exposure to hazardous weather.

Current best practices will be implemented throughout the life of the RO plant. All personnel involved in activities related to the RO project must adhere to Cameco's health and safety management program. This program has been designed to meet all provincial and federal regulations and rules governing safety. Of major concern is the safety of those on site and every reasonable measure will be taken to ensure the well-being of these personnel.

8.3.6 Economy

All activities related to the RO project will require additional employees. As the majority of personnel will be Residents of Saskatchewan North (RSNs), these activities have a positive effect on northern Saskatchewan. Personnel requirements during construction and decommissioning will have the most significant impact. Operation of the RO plant will require a small number of permanent positions at Rabbit Lake. The major economic benefit comes from the ability of an RO plant at Rabbit Lake to extend the life of the mine. Expanding the Eagle Point underground mine requires the ability to treat additional water inflows. The RO project allows for this additional capacity.

8.3.7 Land and Resource Use

8.3.7.1 Traditional and Domestic Use by Aboriginal People

Current operations at Rabbit Lake have had no measureable effect on fish species or water quality in Wollaston Lake. In a situation where there are measureable effects, the installing

and operating of an RO plant is anticipated to reduce the impact of effluent discharge. Because of this, traditional and domestic use of Wollaston Lake by aboriginal people should not be affected. The seasonal and periodic use of fish resources should also be unaffected.

8.3.7.2 Hunting, Trapping, and Fishing for Commercial or Recreational Purposes

The activities associated with the RO project are not expected to impact commercial and recreational activities in the LSA and RSA. Potential effects will be mitigated by citing the physical activities of the project in the provincial lease boundary and using previously disturbed land.

8.3.7.3 Forestry, Mining, and Other Resource Extraction

The Rabbit Lake operation currently has no known impact on forestry, mining, or other resource extraction activities in the area. The RO project is not expected to create additional impacts. Continued mining at Eagle Point may have a positive impact on the Saskatchewan mining industry. The success of uranium mining has the potential to attract exploration and aid in the discovery of new ore bodies, creating new economic opportunities.

8.3.7.4 Physical and Cultural Heritage

Use of previously disturbed land on the Rabbit Lake property ensures that aesthetics and resource use within the LSA or RSA will be not affected. There are no anticipated impacts to physical and cultural heritage due to the activities of the proposed RO project.

9: Stakeholder and Community Engagement

Engaging with stakeholders and communities is rapidly becoming one of the key components of any major assessment in a high-impact industry such as mining. Not only are regulations and laws becoming stricter with regards to environmental impact, but corporations must also show initiative informing the local populations of how the operation intends to conduct business. Global corporations such as Cameco often make additional efforts to ensure affected populations are kept informed and up-to-date on current and future activities. This is a reflection of the corporation's commitment to Corporate Social Responsibility (CSR).

Engaging with concerned parties and remaining reasonably transparent will help to build trust between the Cameco and these parties. This is particularly important when engaging local communities. Standard practice is to employ individuals from these communities, and building a good relationship is imperative to keeping these employment opportunities open. These communities are more likely to accept and even encourage future endeavours by the corporation, such as extending the life of a mining operation through the construction of a reverse osmosis plant. Maintaining good relationships is beneficial for everyone involved. Cameco is primarily concerned with engaging communities that are directly affected by its operations. Mining activities may impact these communities through areas such as traditional use of land and water resources, employment opportunities, or seasonal income through guiding and outfitting. Cameco is committed to understanding these impacts and minimizing the negative impacts if possible.

Consultation with local communities is requirement as part of the permitting process for this project. There are no anticipated problems from the community given that the project will reduce the level of heavy metals being released as a result of mining activity.

9.1 Objectives

Engagement activities involving stakeholders aim to:

- inform the affected populations and the general public about all activities related to the major components of uranium production (mining, milling, refining, etc.)
- understand concerns that stakeholders may have with respect to project activities and to take these concerns into account during subsequent assessments

- provide information about progress of CEAA and/or SEAA assessments for current and future projects
- inform concerned parties of decisions made about particular projects and assessments
- provide opportunities for participants to dialogue regarding any interests, questions, or concerns relating to these projects

9.2 Guiding Principles

Cameco has engaged the leaders of Saskatchewan's northern communities for the purpose of developing guiding principles by which Cameco will operate during the stakeholder engagement process. Below is a summary of the *Draft Principles of Effective Engagement with Northerners*:

- **Open Channels for Communication.** Cameco looks to build understanding relationships with all northerner groups including youth and Elders throughout all stages of activities at Cameco's operations
- **Make it Simple.** By keeping to simple and clear presentation of information and issues, Cameco looks to avoid miscommunication due to language barriers. This will allow concerned parties to provide meaningful comments and feedback.
- **Build Capacity for Understanding.** Cameco wants to identify methods for building the northern people's understanding of technical issues so that engagement can be more involved.
- **Hear the Elders.** Elders within the First Nation and Métis culture are recognized by Cameco as important individuals who want to build their understanding of the uranium industry.
- **Include Youth.** Cameco recognizes the importance of youth as the future of northern communities. Cameco also looks to them as potential future employees. Engagement with these youth regarding the uranium industry is essential.
- **Speak and Hear Our Languages.** Cameco understands the value of traditional aboriginal languages to the northern people. Engagement activities should provide opportunities to share information and concerns in these languages.

9.3 Engagement of Primary Communities

The primary communities impacted by Cameco's operations include those listed in Section 2.4. The location of bodies of water and the flow of water between these bodies helped identify these primary impact groups (see Figure 2-7: Athabasca Basin Communities and Bodies of Water). Communities situated downstream of Cameco operations are considered to be primary impact groups because of the potential for effluent discharge to reach these areas.

Within these communities, Cameco is targeting specific groups of individuals, such as mayors, councils, chiefs, elders, youth, business leaders, traditional land users, educators, and other interested community groups. Engagement may come in the form of meetings with community leaders, project-specific workshops, Athabasca EQC meetings, Athabasca Working Group (AWG) meetings, site tours and visits, and Cameco liaison offices.

Engagement activities are still evolving and Cameco continually looks to improve methods of consultation between the corporation and the groups impacted by the corporation's activities.

10: Economic Analysis

The need to justify expenditure for the RO plant requires an economic assessment. Without installing an RO plant at the Eagle Point mine, the mine would have to shut down at the end of the 2012 as water treatment capacity at the Rabbit Lake mill would reach its full capacity and no further mine development could be accomplished.

Shutting down Eagle Point at the end of 2012 would mean the site would go into care and custody (C&C) until Cigar Lake production arrives at the end of 2016. This assessment will determine whether Cameco should invest in an RO plant to keep the Eagle Point mine production going or should it shut down the Eagle Point mine at the end of 2012 and go on C&C.

10.1 Care and Custody (No More Eagle Point)

The cost of C&C has been estimated at \$25–35 million per year (estimated from past C&C years). For this assessment, it will be assumed that the cost will be \$25 million per year, since a higher cost would only make the RO plant costs more attractive. In the case where an RO plant was not constructed, the site would be on care and custody from 2013 to 2015 inclusive.

10.2 Capital to Keep the Eagle Point Mine Operational

To keep Rabbit Lake operation running, a new RO plant would be needed, but in addition other capital projects would be required, including

- a new tailings facility, as the current tailings facility is almost full
- mine development capital to open additional areas of Eagle Point
- regular sustaining capital to keep the mine and mill operating
- mill Projects to optimize operation and to meet regulatory compliance

10.3 RO Plant Capital

A capital cost estimate to build a new RO plant at the Eagle Point mine was done by WARDROP consulting and Cameco Corporation. The total capital cost of that facility was estimated at \$26 million.

Because of the uncertainty of growth potential of the Eagle Point mine, the RO plant will be designed to add future capacity. Also, a modular plant would be constructed. This will allow the RO plant to be moved to other locations (mines). The majority of the cost would not be sunk cost.

10.4 Operating Cost

The mine accounting group has projected operating costs for the Rabbit Lake operation, if the Eagle Point mine and mill were to remain in operation until the arrival of Cigar Lake solution in 2016. For the purpose of this comparison it will be assumed that the Eagle Point production from 2012 to 2015 will be 26.7 million pounds based on the life-of-mine plan.

10.5 Discount Rate

Every company has its own cost of capital number or discount rate. For Cameco the discount rate is ~8%. Cameco considers that a long-term bond rate might be about 4% with very low risk. Therefore, Cameco adds an extra 4% to account for the risk.

10.6 Other Assumptions

Price of uranium (U_3O_8) = \$50 (US) per pound

\$CAD/\$US = 1.0

Cost of capital = 8%

11: Economic Assessment

11.1 Net Present Value

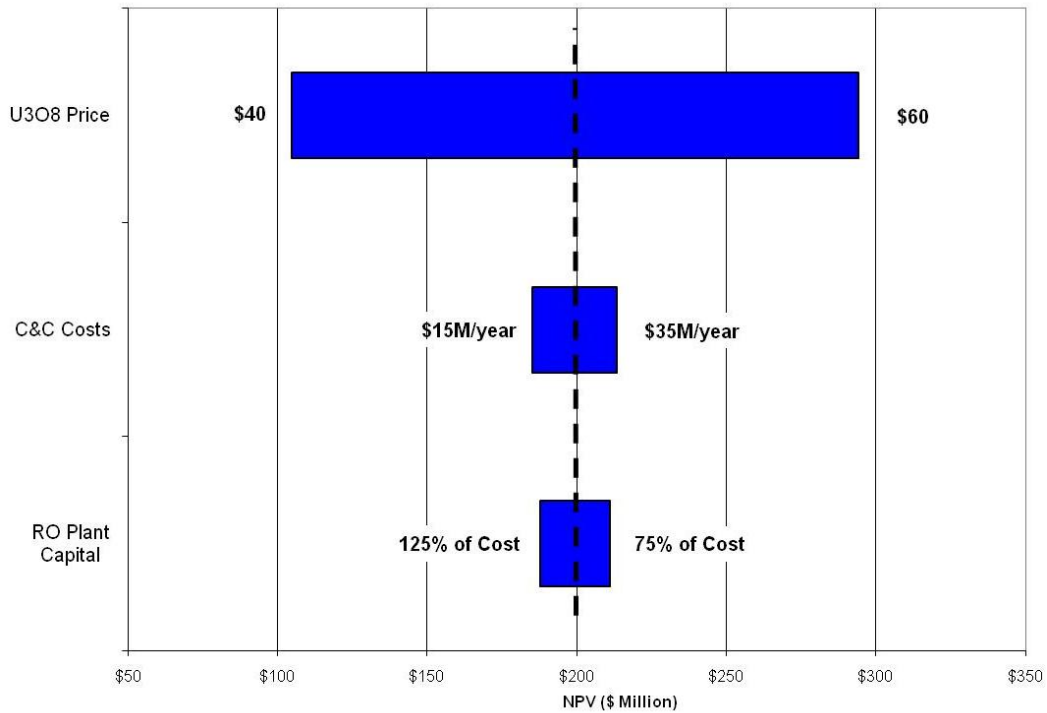
The assessment was made by comparing the net present value (NPV) of a case where an RO plant was constructed and the Eagle Point mine operated 2018. A second case was done in which both the Eagle Point mine and the Rabbit Lake mill would shut down at the end of 2012 and only the mill would be restarted when the Cigar Lake solution arrives at the Rabbit Lake operation at the end of 2016. These two assessments are in Appendix B.

Based on these two cases, it was found that the RO plant increases the total NPV of RL by just under \$185.2 million.

11.2 Sensitivity Analysis

Different assumptions were changed to examine the impact on the incremental NPV. The U_3O_8 price, C&C costs, and RO plant capital were individually changed to see their impact on the NPV. These results were summarized in the tornado diagram in Figure 11-1. The price of U_3O_8 was the most sensitive assumption, whereas the RO plant capital and C&C costs had a much less impact on the NPV.

Figure 11-1: Tornado Diagram of NPV Increase



11.3 Break-Even Point

With the above assumptions for cost per pound of U_3O_8 the break-even point was calculated based on U_3O_8 production. In order for the operation to break even, EP will have to produce roughly 3.8 million pounds.

11.4 Benefit–Cost Ratio

The benefit–cost ratio (BCR) or profitability index was also calculated for the scenario in which the EP mine is not operated. It was determined that BCR was 4.0. The BCR for operating the EP mine was 2.9. There is very little difference between these two scenarios. Both scenarios yielded BCRs in excess of 1.0, and are therefore both scenarios are attractive.

11.5 Economic Summary

The analysis focused on which case added more value; it was determined that constructing an RO plant added more value than going on care and custody. It is estimated the RO plant increases the total NPV of the Rabbit Lake operation by just under \$185.2 million as result of processing of 26.7 million pounds of U_3O_8 from the Eagle Point mine. The break-even point of investing in the RO Plant was only 3.8 million pounds of U_3O_8 from the EP mine. There was very little difference between the BCR for either scenarios, and both yielded above the attractive investment BCR of 1.0. On the sensitivity analysis, the NPV was mostly influenced by the price of U_3O_8 , but Cameco sells U_3O_8 under long-term contracts, therefore the risk is minimized.

12: Conclusion

Additional water inflows have the potential to halt production at Rabbit Lake if they cannot be treated effectively. The proposed reverse osmosis plant for Cameco's Rabbit Lake operation is expected to permit the continued production of the Eagle Point mine through creating additional capacity for mine water inflows. A function of this RO plant will be to remove a significant amount of water from the Eagle Point effluent and discharge it to Collins Bay. A reduced but more concentrated effluent stream will be treated at the Rabbit Lake mill before being released to the environment.

The final effluent is expected to be lower in contaminants than the current effluent being discharged. This expectation is backed by years of historical and test work data collected at both the Rabbit Lake and Key Lake operations. Overall, the reverse osmosis facility is anticipated to reduce Rabbit Lake's negative impact to the environment and improve positive impacts to the residents of the Athabasca Basin.

Installing the RO plant means that the RL mill will have sufficient ore to process and will not be required to go to care and custody with the expectation of reopening when Cigar Lake product arrives for further processing in 2016. This is very attractive, given both the cost of maintenance and start-up and the challenge of assembling a qualified workforce from scratch if the RL mill had to shut down.

Appendix A: Timeline of Uranium Spot Price Movements

Figure 12-1: Timeline of Uranium Spot Price Movements, 1987–2004

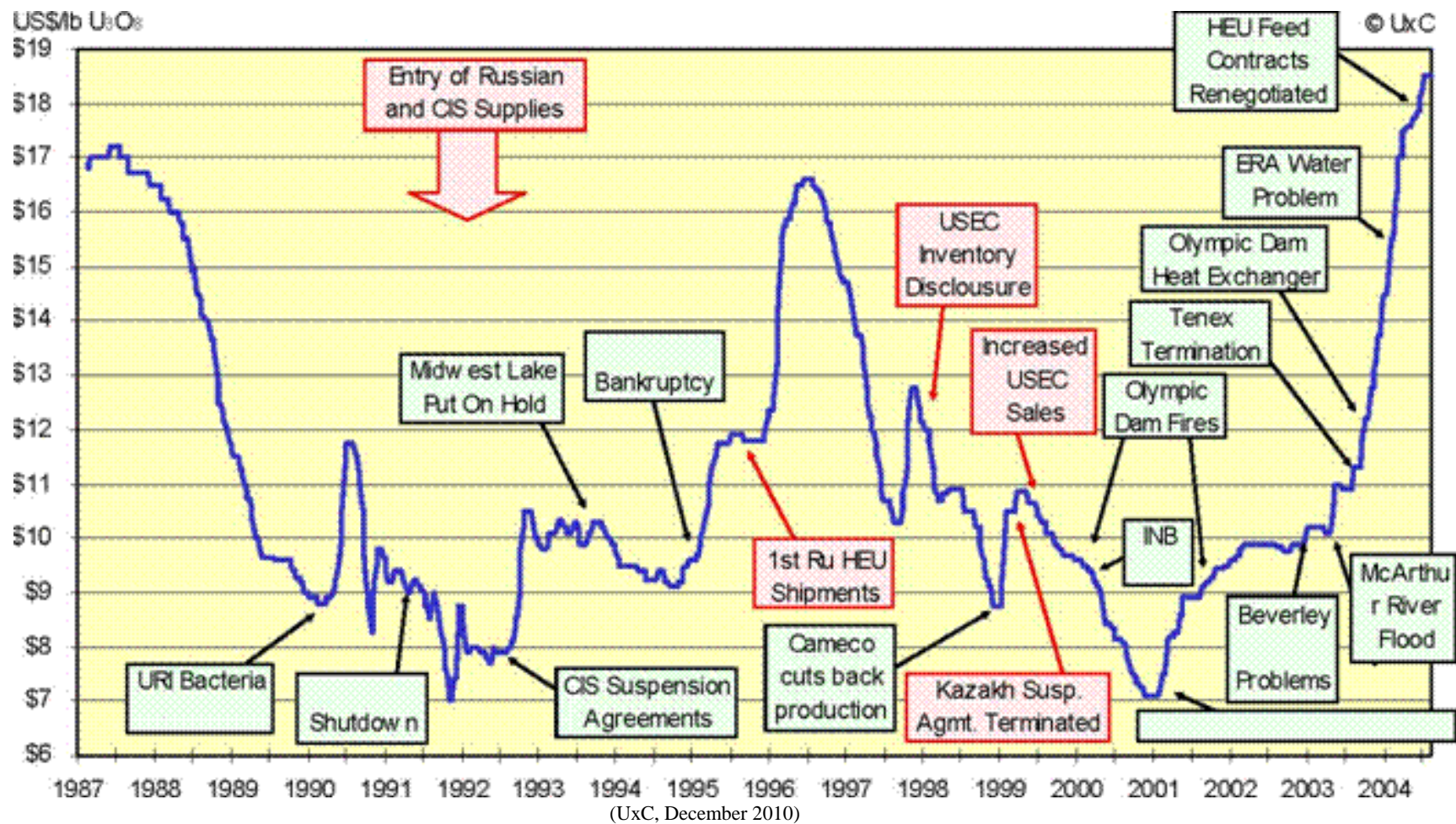
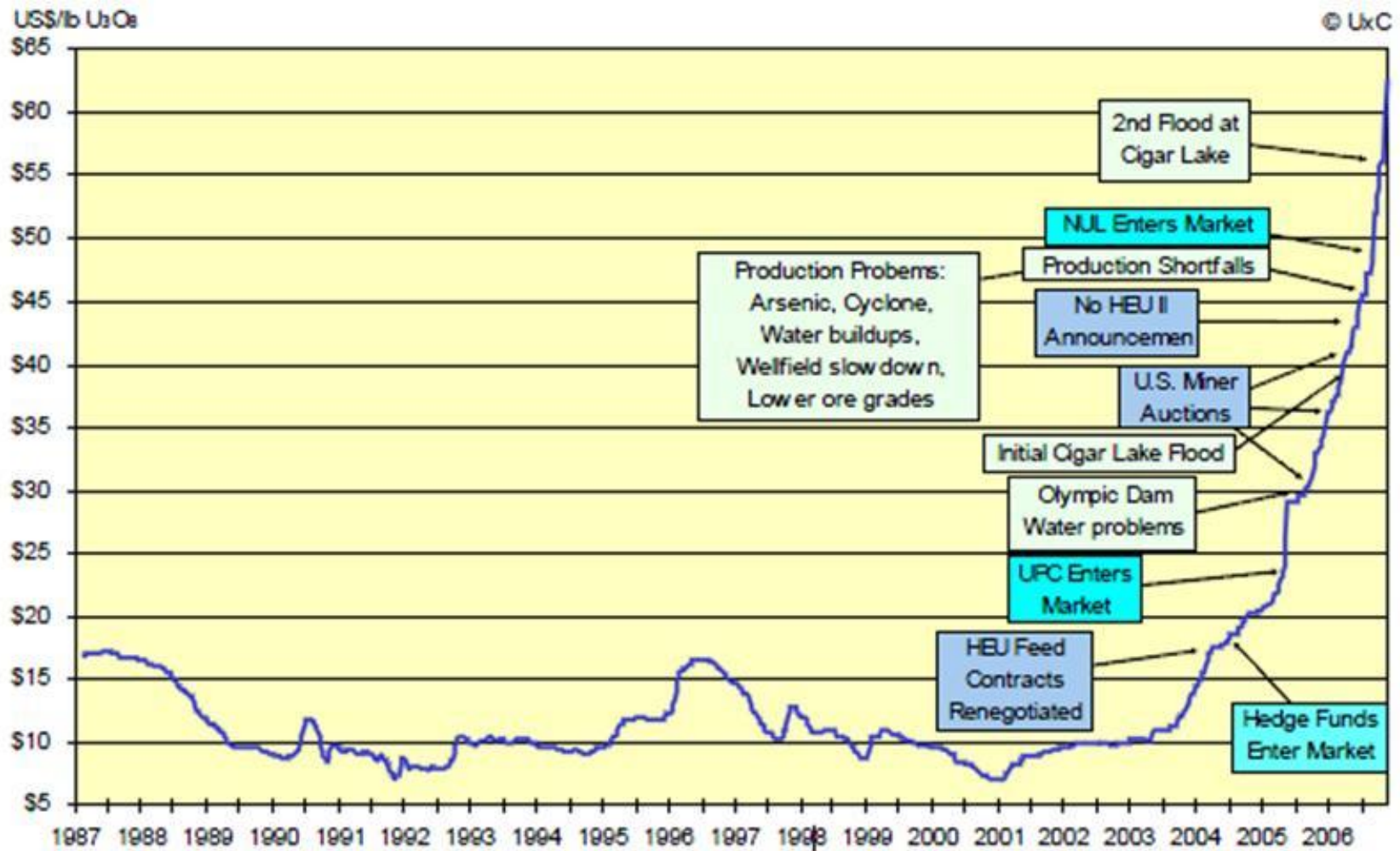
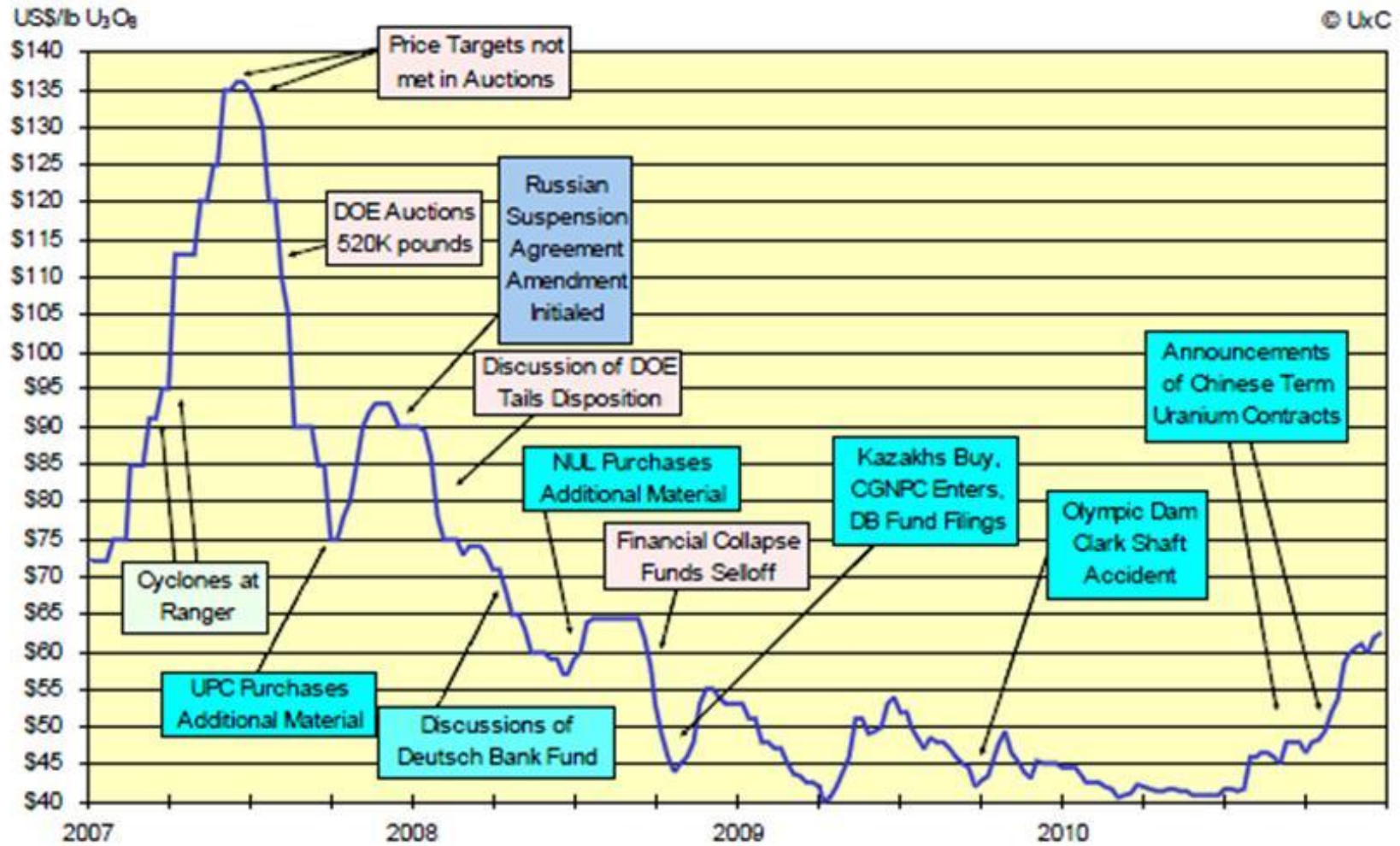


Figure 12-2: Timeline of Uranium Spot Price Movements, 2004-2006



(UxC, December 2010)

Figure 12-3: Timeline of Uranium Spot Price Movements, 2006-2010



(UxC, December 2010)

Appendix B: Economic Assessments

Figure 12-4: Economic Assessment - Eagle Point Operating Until 2017

Project Name	Eagle Point Operating until 2017												
	units	NPVs	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Totals
Production - Cameco Share	Mlbs		3.70	3.83	3.83	3.83	3.83	6.53	13.76	10.96	10.00	10.00	70.25
Cameco Share	100.000%	Rabbit Lake Eagle Point											
Discount Rate	8%												
Production	Mlbs		3.70	3.83	3.83	3.83	3.83	6.53	13.76	10.96	10.00	10.00	70.25
Sales Price in US\$	US\$/lb		50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	
Forex	US\$/C\$		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Sales Price in C\$	C\$/lb		50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	
Revenue	M\$	1,984.1	185.0	191.4	191.4	191.4	191.4	326.4	687.8	547.8	500.0	500.0	3,512
Capital Cost													
RO Plant	M\$	26.0	8.50	21.20	-	-	-	-	-	-	-	-	30
Tailings Pond Capex	M\$	54.1	2.00	1.00	1.00	10.00	20.00	28.50	20.00	-	-	-	83
Mine Development	M\$	55.0	18.80	16.30	11.60	11.40	8.90	-	-	-	-	-	
Sustaining	M\$	70.0	25.82	24.90	16.58	11.91	9.20	2.13	1.13	0.13	0.13	0.13	92
Mill Projects	M\$	46.9	18.10	19.00	14.50	3.00	3.00	3.00	-	-	-	-	61
Total Capital		252.1	73.22	82.40	43.68	36.31	41.10	33.63	21.13	0.13	0.13	0.13	264.85
Operating Savings (Expense)													
Expense	M\$		\$ 130.46	\$ 128.27	\$ 127.58	\$ 128.33	\$ 132.63	\$ 70.00	\$ 108.38	\$ 104.97	\$ 100.21	\$ 100.33	
Total Operating Savings (Expense)	M\$	719.7	130.46	128.27	127.58	128.33	132.63	70.00	108.38	104.97	100.21	100.33	1,131.16
Net Cash Flow before royalties		719.7	(18.68)	(19.30)	20.11	26.73	17.64	222.75	558.31	442.71	399.66	399.54	1,396.00
Basic Royalty	4%	79.4	7.40	7.65	7.65	7.65	7.65	13.05	27.51	21.91	20.00	20.00	140
Capital Resource Tax	3%	59.5	5.55	5.74	5.74	5.74	5.74	9.79	20.63	16.43	15.00	15.00	105
Tiered Royalty	below	147.8	13.78	14.25	14.25	14.25	14.25	24.31	51.23	40.80	37.24	37.24	262
Total Royalties		286.7	26.73	27.65	27.65	27.65	27.65	47.16	99.38	79.15	72.24	72.24	508
Net Cash Flow, incl royalties		-	45.41	46.95	7.54	0.92	10.01	175.59	458.93	363.56	327.42	327.30	1,904
IRR	%	56.6%											
BCR		2.9											
Annual Pre-Tax Net Cash Flow	M\$	735.6	-45.41	-46.95	-7.54	-0.92	-10.01	175.59	458.93	363.56	327.42	327.30	1,542

Figure 12-5: Economic Assessment - Eagle Point Operating Until 2017

Project Name	Eagle Point Operating until 2017												
	units	NPVs	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Totals
Production - Cameco Share	MIbs		3.70	3.83	3.83	3.83	3.83	6.53	13.76	10.96	10.00	10.00	70.25
Cameco Share Discount Rate	100.000% 8%	Rabbit Lake Eagle Point											
Production	MIbs		3.70	3.83	3.83	3.83	3.83	6.53	13.76	10.96	10.00	10.00	70.25
Sales Price in US\$	US\$/lb		50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	
Forex	US\$/C\$		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Sales Price in C\$	C\$/lb		50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	
Revenue	M\$	1,984.1	185.0	191.4	191.4	191.4	191.4	326.4	687.8	547.8	500.0	500.0	3,512
Capital Cost													
RO Plant	M\$	26.0	8.50	21.20	-	-	-	-	-	-	-	-	30
Tailings Pond Capex	M\$	54.1	2.00	1.00	1.00	10.00	20.00	28.50	20.00	-	-	-	83
Mine Development	M\$	55.0	18.80	16.30	11.60	11.40	8.90	-	-	-	-	-	
Sustaining	M\$	70.0	25.82	24.90	16.58	11.91	9.20	2.13	1.13	0.13	0.13	0.13	92
Mill Projects	M\$	46.9	18.10	19.00	14.50	3.00	3.00	3.00	-	-	-	-	61
Total Capital		252.1	73.22	82.40	43.68	36.31	41.10	33.63	21.13	0.13	0.13	0.13	264.85
Operating Savings (Expense)													
Expense	M\$		\$ 130.46	\$ 128.27	\$ 127.58	\$ 128.33	\$ 132.63	\$ 70.00	\$ 108.38	\$ 104.97	\$ 100.21	\$ 100.33	
Total Operating Savings (Expense)	M\$	719.7	130.46	128.27	127.58	128.33	132.63	70.00	108.38	104.97	100.21	100.33	1,131.16
Net Cash Flow before royalties		719.7	(18.68)	(19.30)	20.11	26.73	17.64	222.75	558.31	442.71	399.66	399.54	1,396.00
Basic Royalty	4%	79.4	7.40	7.65	7.65	7.65	7.65	13.05	27.51	21.91	20.00	20.00	140
Capital Resource Tax	3%	59.5	5.55	5.74	5.74	5.74	5.74	9.79	20.63	16.43	15.00	15.00	105
Tiered Royalty	below	147.8	13.78	14.25	14.25	14.25	14.25	24.31	51.23	40.80	37.24	37.24	262
Total Royalties		286.7	26.73	27.65	27.65	27.65	27.65	47.16	99.38	79.15	72.24	72.24	508
Net Cash Flow, incl royalties		-	45.41	46.95	7.54	0.92	10.01	175.59	458.93	363.56	327.42	327.30	1,904
IRR	%	56.6%											
BCR		2.9											
Annual Pre-Tax Net Cash Flow	M\$	735.6	-45.41	-46.95	-7.54	-0.92	-10.01	175.59	458.93	363.56	327.42	327.30	1,542

13: Bibliography

Business Balls. (n.d.). Retrieved April 2011, from <http://www.businessballs.com/portersfiveforcesofcompetition.htm>

Cameco Corporation. (1982). *The Rabbit Lake Mill Operation Past, Present and Future*.

Cameco Corporation (1992). *Environmental Impact Statement Collins Bay A-Zone, D-Zone and Eagle Point Development. Prepared for Canadian Nuclear Safety Commission and Saskatchewan Environment and Resource Management*.

Cameco Corporation. (2001). *Rabbit Lake Operation Annual Environmental Report. Prepared for Canadian Nuclear Safety Commission and Saskatchewan Environment and Resource Management*.

Cameco Corporation. (2005). *Eagle Point/Rabbit Lake Water Handling Assessment. July*.

Cameco Corporation.(2006). *Rabbit Lake Operation Uranium Reduction in the Rabbit Lake Effluent. December*.

Cameco Corporation. (2008a). *Rabbit Lake Solution Processing Project Environmental Impact Statement*.

Cameco Corporation. (2008b). *Rabbit Lake Solution Processing Project Environmental Impact Statement. January*.

Cameco Corporation. (2008c). *Rabbit Lake Operation Annual Environmental Report. Prepared for Canadian Nuclear Safety Commission and Saskatchewan Environment and Resource Management*.

Cameco Corporation. (2008d). *Rabbit Lake Operation: Pit Crest Modification. March. Prepared for Canadian Nuclear Safety Commission and Ministry of Environment*.

Cameco Corporation.(2009). *Rabbit Lake Eagle Point Membrane Plant Analysis. January*

Cameco Corporation. (2010). *Cameco's Contracting*.

Cameco Corporation. (2010). *Cameco's Marketing*.

Cameco Corporation. (2010). *Eagle Point Water Managment. July. Prepared for Canadian Nuclear Safety Commission*.

Cameco Corporation. (2010). *Powel Zone Underground Access and Exploration. December*.

Cameco Corporation. (2011). *Life of Mine Plan Summary Eagle Point Mine. March*.

- Cameco Corporation. (2011). *Eagle Point Water Treatment Capacity Upgrades Pre-Feasibility Report*. April.
- Canada North Environmental Services (CanNorth). (2006). *Spring Fish Spawning and Larval Emergence Investigation in Horseshoe Creek*. Updated Draft Field Visit Report. Prepared for Cameco Corporation. July.
- Canada North Environmental Services (CanNorth). (2006). *Lake Whitefish Spawning and Larval Investigations in Collins Creek, Northern Saskatchewan*. Final Report. Report prepared for Cameco Corporation. October 2006.
- Graden, R. (2006). *Strategic Viability Analysis of a Hydrometallurgical Refinery at Highland Valley Copper*.
- Golder Associates. (2009). *Rabbit Lake Operation Collins Bay Aquatic Survey*. Report 08-1365-0085.
- Government of Canada. (2008). *Major Project Management Office Guide to Preparing a Project Description for a Major Resource Project*.
- International Energy Outlook*. (n.d.). Retrieved March 2011, from <http://www.eia.doe.gov/oiaf/ieo/>
- Melis Engineering LTD. (2011). *Rabbit Lake Site Preliminary Water Balance Estimated Loadings to Horseshoe Creek*. March.
- Nuclear Energy Institute*. (n.d.). Retrieved March 2011, from http://www.nei.org/resourcesandstats/nuclear_statistics/environmentemissionsprevented/
- Rawson, D.S., (1951). *Preliminary observations on Wollaston Lake*. Unpublished report, Fisheries Branch, Saskatchewan. Department of Natural Resources.
- Rawson, D.S., (1959). *Limnology and Fisheries of Cree and Wollaston Lakes in Northern Saskatchewan*. Report No. 4, Fisheries Branch, Saskatchewan Department of Natural Resources.
- Saskatchewan Ministry of Environment (2003). *Guidelines for the Preparation of a Project Proposal*.
- Sawchyn, W.W. (1973). *Environmental Survey of Wollaston Lake, Saskatchewan*. Saskatchewan Research Council, Report C 73-5.
- Sawchyn, W.W. (1973). *Hydrological Survey Hidden Bay, Wollaston Lake, Saskatchewan*. Saskatchewan Research Council, Report RAB G84 73-1.
- UxC. (2010). *Nuclear Industry Value Chain*. March
- UxC. (2010). *Nuclear Industry Value Chain*. December.

UxC. (2010). *Uranium Suppliers Annual*. December.